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## AERONAUTICAL WIND TUNNELS EUROPE AND ASIA

*A Report Prepared by the Federal Research Division,  
Library of Congress  
under an Interagency Agreement with the NASA Aeronautics Research Mission Directorate*

*February 2006*

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Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE <b>FEB 2006</b>		2. REPORT TYPE		3. DATES COVERED <b>00-00-2006 to 00-00-2006</b>	
4. TITLE AND SUBTITLE <b>Aeronautical Wind Tunnels Europe and Asia</b>				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) <b>Federal Research Division, Library of Congress, Washington, DC, 20540-4840</b>				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT <b>Approved for public release; distribution unlimited</b>					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT <b>Same as Report (SAR)</b>	18. NUMBER OF PAGES <b>363</b>	19a. NAME OF RESPONSIBLE PERSON
a. REPORT <b>unclassified</b>	b. ABSTRACT <b>unclassified</b>	c. THIS PAGE <b>unclassified</b>			

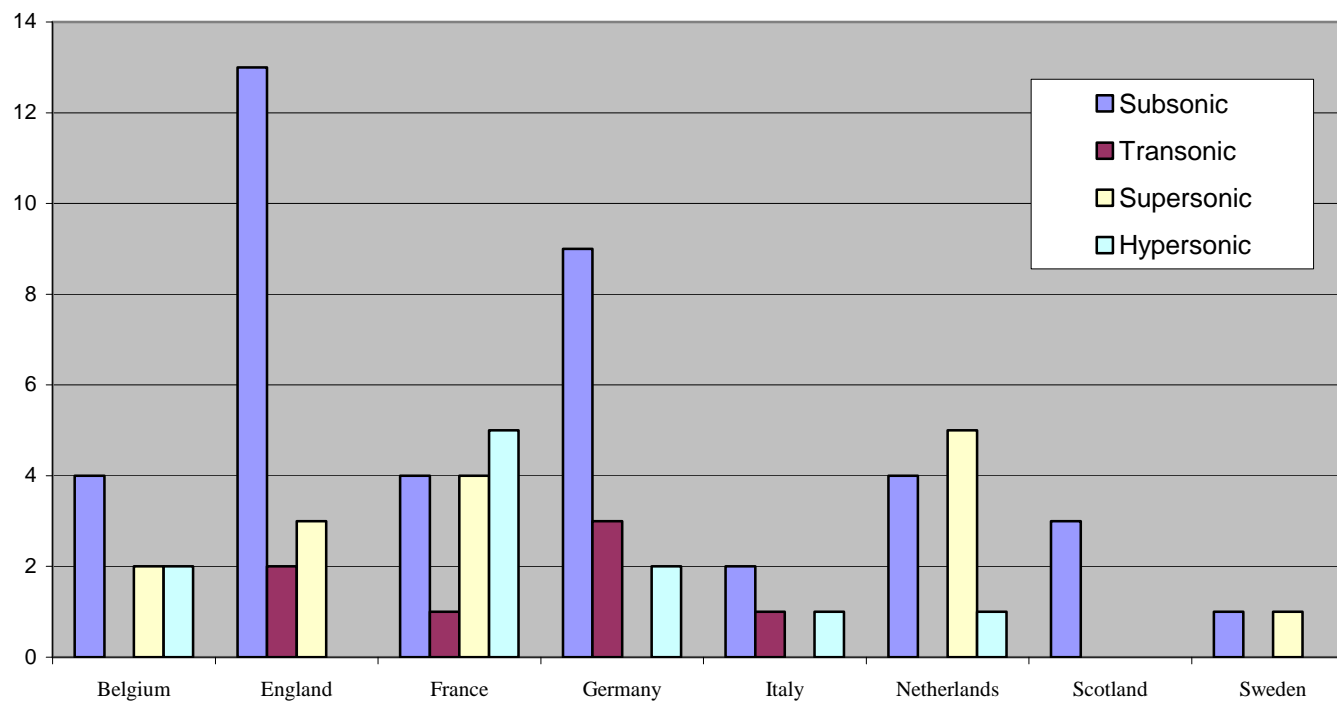
## PREFACE

This catalog is a compilation of data on subsonic, transonic, supersonic, and hypersonic wind tunnels used for aeronautical testing in Europe and Asia. The countries represented in this catalog include Belgium, China, France, Germany, Indonesia, Italy, Japan, Malaysia, the Netherlands, the Republic of Korea (ROK, South Korea), Singapore, Sweden, and the United Kingdom. The catalog profiles a total of 155 wind tunnels. A distribution chart and bar charts immediately following this preface depict the number and types of tunnels operating in each country. The bulk of the catalog is made up of data sheets for each facility describing its name; the name of the installation where it is located; technical parameters such as size, speed range, temperature range, pressure, operational status, and Reynolds number; replacement cost and operation cost; testing capabilities; current programs; planned improvements; contact information; and schematics, when available. The report is divided into five sections, one for each speed (subsonic, transonic, supersonic, and hypersonic) as well as a section for those tunnels for which the speed is unknown. A table of contents heads each of these sections. In addition, cross-reference indexes with page numbers based on location, company name, facility name, and schematics are included at the end of the catalog as quick look-up tools. A bibliography is also included. Sources consulted include wind tunnel installation Web sites (in English and other languages), technical reports on wind tunnels published by Sverdrup Technology, RAND, NASA and in various technical journals as well as information provided by installation managers in response to direct inquiries. All web sites are current as of the publication date. If a Web site is no longer active, we recommend searching on the wind tunnel name or owner organization name to obtain the current Web address.

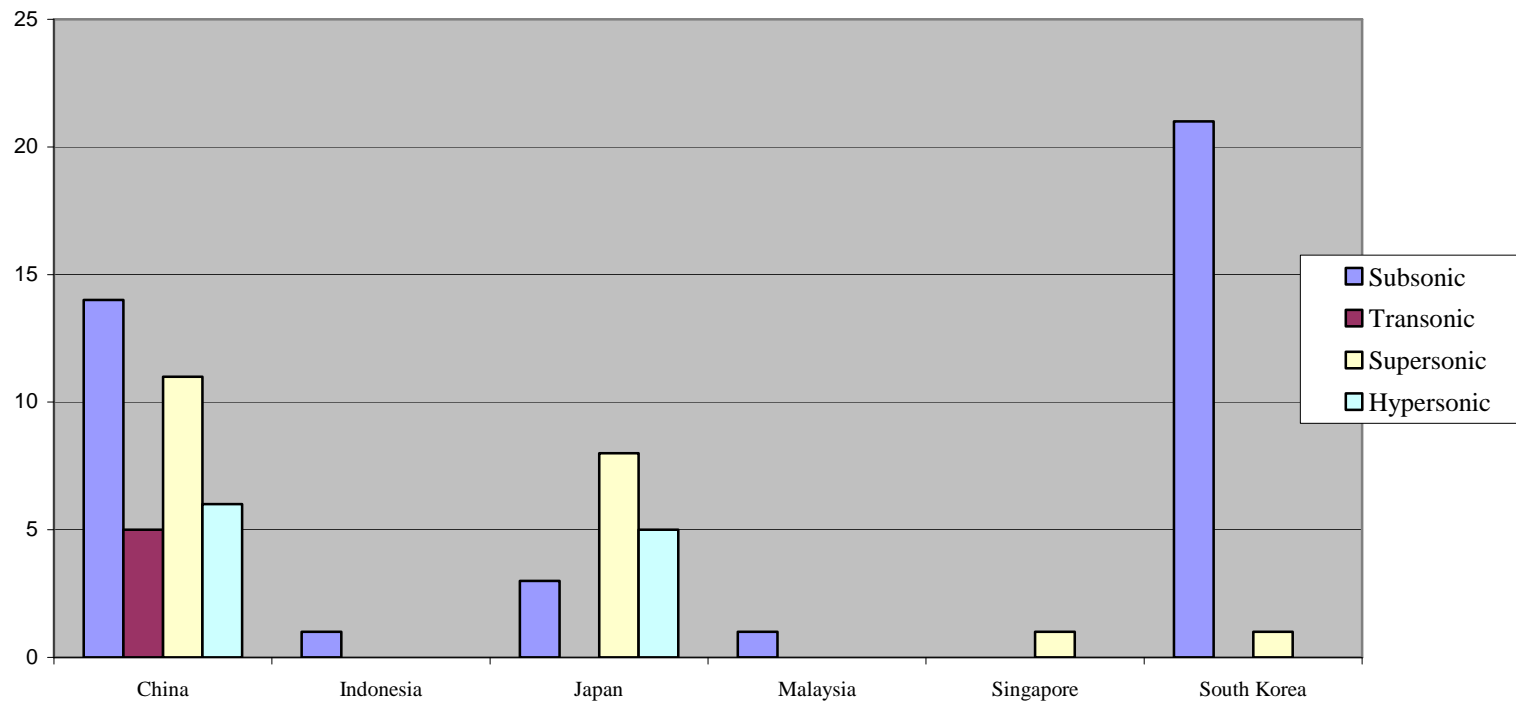
**AERONAUTICAL WIND TUNNELS DISTRIBUTION**  
**Asia and Europe**

<b>Location</b>	<b>Subsonic</b>	<b>Transonic</b>	<b>Supersonic</b>	<b>Hypersonic</b>	<b>Unknown</b>
Belgium	4	0	2	2	
England	13	2	3	0	
France	4	1	4	5	
Germany	9	3	0	2	
Italy	2	1	0	1	
Netherlands	4	1	5	0	
Scotland	3	0	0	0	
Sweden	1	1	0	0	
<b>Europe Subtotal</b>	40	10	14	10	0
China	14	5	11	6	4
Indonesia	1	0	0	0	
Japan	3	0	8	5	1
Malaysia	1	0	0	0	
Singapore	0	1	0	0	
South Korea	21	0	0	0	
<b>Asia Subtotal</b>	40	6	19	11	5
<b>Grand Total</b>	<b>80</b>	<b>16</b>	<b>33</b>	<b>21</b>	<b>5</b>

Aeronautical Wind Tunnels-Europe



Aeronautical Wind Tunnels - Asia



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# European and Asian Wind Tunnels

Subsonic

Belgium

Installation Name	Test Section Size	Speed Range
Von Karman Institute for Fluid Dynamics (VKI), Saint Genese, Belgium	100 x 117 x 800 mm (with flexible top and bottom walls)	80 m/s
		Temperature Range
	Date Built/Upgrade	120°K
Facility Name		Reynolds Number (million)
Adaptive Wall Low Speed Wind Tunnel T-3		0.2 to 1
	Cost	Dynamic Pressure
	Operational Status	Stagnation Pressure
	Presumed active as of September 2005	4 bar

## Supplementary Technical Parameters

The T-3 was built as the pilot facility for the cryogenic T-2 transonic pressurized tunnel at VKI. It has 5-mm stainless steel walls and a 11,400-RPM fan speed. Injection. Under ambient conditions with a 7.5-kW motor, yields Mach 0.23 (80m/s) in the test section. Originally built by Onera for transonic operation.

## Data Acquisition

## Testing Capabilities/Current Programs

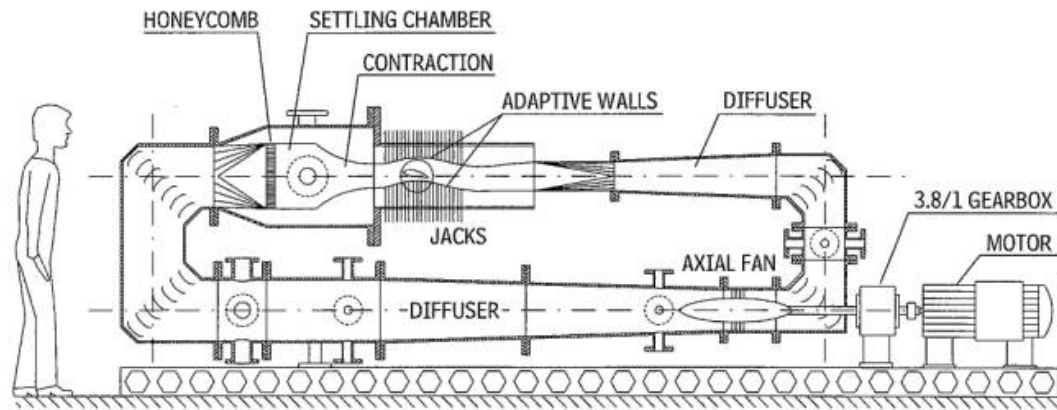
## Planned Improvements

## User Fees

## Contact Information

Olivier Chazot, Von Karman Institute for Fluid Dynamics, B-1640 Rhode, Genese, Belgium.  
Tel: (32) 02 359 96 11, Fax: (32) 02 359 96 00, Email: [chazot@vki.ac.be](mailto:chazot@vki.ac.be), Web site: <http://www.vki.ac.be/virtual/facility/pdf/t3.pdf>.

## European and Asian Wind Tunnels



**Adaptive Wall Low-Speed Wind Tunnel T-3, Von Karman Institute, St. Genese, Belgium.**

# European and Asian Wind Tunnels

Subsonic

Belgium

Installation Name	Test Section Size	Speed Range
Von Karman Institute for Fluid Dynamics (VKI), Saint Genese, Belgium	0.1 x 0.3 x 1.6 m	70 m/s (max)
		Temperature Range
	Date Built/Upgrade	as low as -40°C
Facility Name		Reynolds Number (million)
CWT-1 Cold Wind Tunnel	Cost	
		Dynamic Pressure
	Operational Status	
	Presumed active as of September 2005	Stagnation Pressure

## Supplementary Technical Parameters

Low-speed, closed-circuit wind tunnel, 8-kW motor. Operates at sub-freezing temperatures. Built of wood and epoxy-fiberglass composite. Internally insulated with a 5-cm layer of polystyrene foam, covered by smooth epoxy lining. The settling chamber, fitted with a honeycomb, is followed by a 12.4:1 contraction ratio. The centrifugal fan is driven by a PC-controlled variable-speed 8-kW DC motor.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

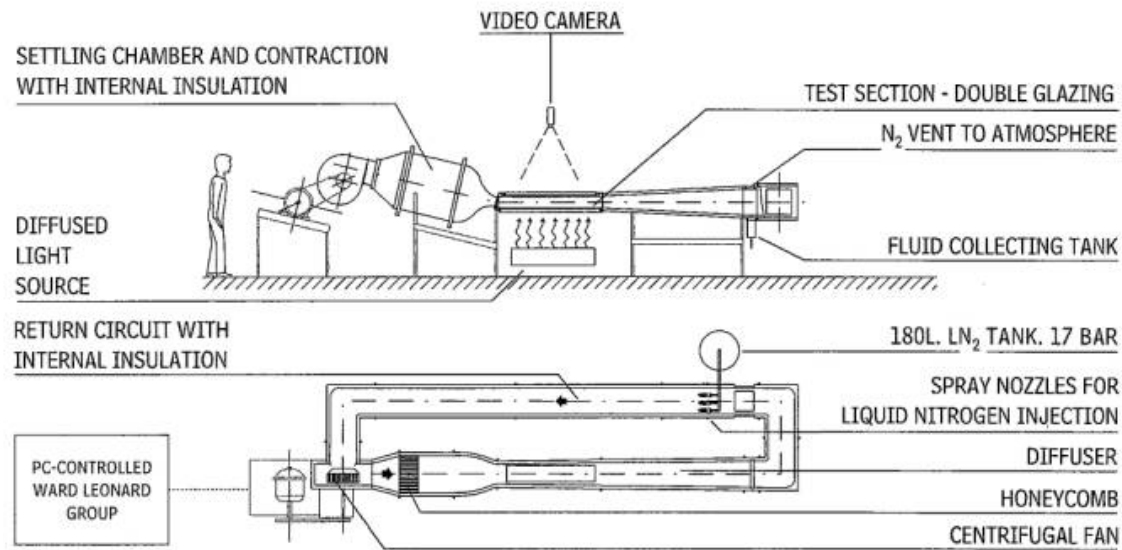
## User Fees

## Contact Information

Olivier Chazot, Von Karman Institute for Fluid Dynamics, B-1640 Rhode, Genese, Belgium.

Tel: (32) 02 359 96 11, Fax: (32) 02 359 96 00, Email: [chazot@vki.ac.be](mailto:chazot@vki.ac.be), Web site: <http://www.vki.ac.be/facilities/pdf/cwt1.pdf>.

## European and Asian Wind Tunnels



**CWT-1 Cold Wind Tunnel, Von Karman Institute, St. Genese, Belgium.**



# European and Asian Wind Tunnels

Subsonic

Belgium

Installation Name	Test Section Size	Speed Range
Von Karman Institute for Fluid Dynamics (VKI), Saint Genese, Belgium	3 x 4.5 m (free jet test section)	2 to 60 m/s
		Temperature Range
	Date Built/Upgrade	
Facility Name		Reynolds Number (million)
L-1A Low Speed Wind Tunnel	Cost	
		Dynamic Pressure
	Operational Status	
	Presumed active as of October 2005	Stagnation Pressure

## Supplementary Technical Parameters

Open-jet test section. Variable speed, 580-kW DC motor. Contraction ratio of 4:1. Typical turbulence level of 0.3%.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

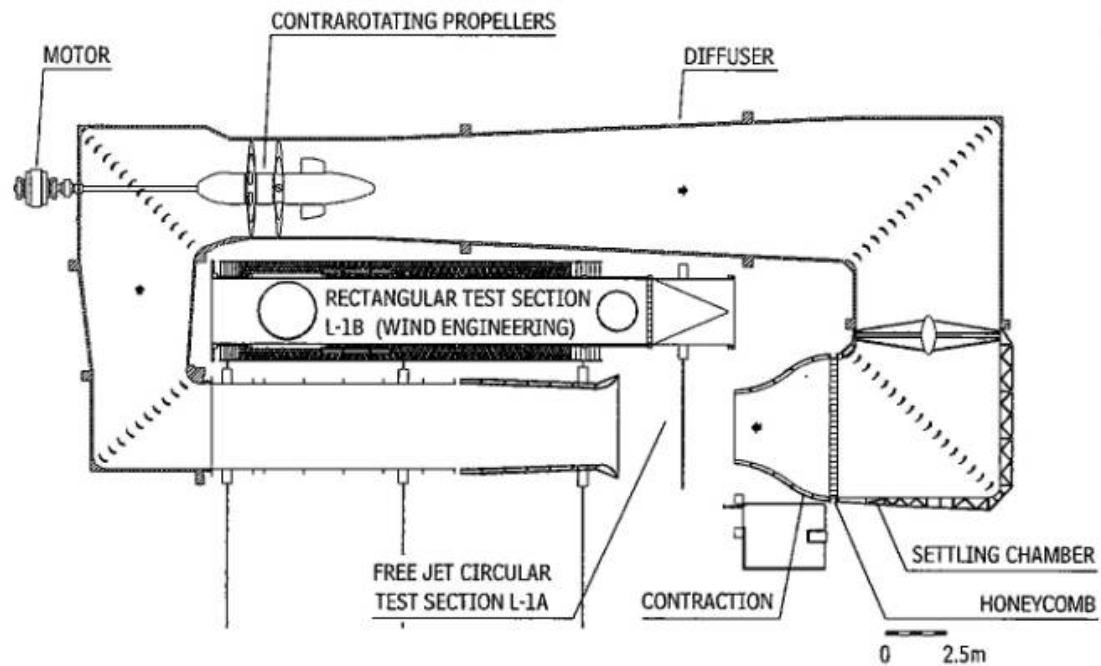
## User Fees

## Contact Information

Olivier Chazot, Von Karman Institute for Fluid Dynamics, B-1640 Rhode, Genese, Belgium.

Tel: (32) 02 359 96 11, Fax: (32) 02 359 96 00, Email: [chazot@vki.ac.be](mailto:chazot@vki.ac.be), Web site: <http://www.vki.ac.be/facilities/pdf/11a.pdf>.

## European and Asian Wind Tunnels



**L-1A Low-Speed Wind Tunnel, Von Karman Institute for Fluid Dynamics (VKI), St. Genese, Belgium.**

# European and Asian Wind Tunnels

Subsonic

Belgium

Installation Name	Test Section Size	Speed Range
Von Karman Institute for Fluid Dynamics (VKI), Saint Genese, Belgium	0.28 m (width) x 1.3 m (length)	45 m/s (max)
		Temperature Range
	Date Built/Upgrade	
Facility Name		Reynolds Number (million)
L-2A Low Speed Wind Tunnel	Cost	
		Dynamic Pressure
	Operational Status	
	Presumed active as of September 2005	Stagnation Pressure

## Supplementary Technical Parameters

Low-speed, open-circuit wind tunnel having an air inlet, settling chamber circular cross-section with honeycomb and meshes, asymmetric 8:1 contraction ratio. A two-directional traversing mechanism located in the test section. Axial fan, at the end of a 1:4 diffuser, driven by a 9.9-kW variable speed DC motor. Turbulence level of 0.2 %.

## Data Acquisition

## Testing Capabilities/Current Programs

Research projects and laboratory training in turbulent boundary layers, aircraft wakes, vortex-strake interactions, three-dimensional velocity measurements and, with the addition of a smoke generator and of an air exhaust to outside, laser sheet flow visualizations.

## Planned Improvements

## User Fees

## Contact Information

Olivier Chazot, Von Karman Institute for Fluid Dynamics, B-1640 Rhode, Genese, Belgium.

Tel: (32) 02 359 96 11, Fax: (32) 02 359 96 00, Email: [chazot@vki.ac.be](mailto:chazot@vki.ac.be), Web site: <http://www.vki.ac.be/facilities/pdf/l2a.pdf>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Subsonic

China

Installation Name	Test Section Size	Speed Range
China Academy of Aerospace Aerodynamics (CAAA), Beijing, China AKA: Beijing Institute of Aerodynamics (BIA) or 701st Institute of the China Aerospace Science & Technology Corporation (CASC)	3 x 3 x 12 m	10 to 100 m/s
		Temperature Range
	Date Built/Upgrade	
Facility Name		Reynolds Number (million)
Low Speed Wind Tunnel	Cost	6
		Dynamic Pressure
	Operational Status	
	Presumed active as of November 2005	Stagnation Pressure

## Supplementary Technical Parameters

Stepless regulation of airflow speed.

## Data Acquisition

## Testing Capabilities/Current Programs

Measurement of pressure and forces on vehicle models, control tests of rudder hinge movements and aircraft dynamics at high angles of attack, external objects jettison (including ejection seats) and multi-body separation tests, folding wing deployment tests, simulation of jet interference and direct force, flutter and rotating model tests, tests of ground wind loads and ground effects on aircraft and buildings, drag chute performance tests, simulation tests of high-speed vehicles and ships, flow visualization

## Planned Improvements

## User Fees

## Contact Information

Li Feng (Director), China Academy of Aerospace Aerodynamics (CAAA), 17 Yungang West Road, Fengtai District, Beijing 100074, China.  
Tel: (86) 10 68740603, Fax: (86) 10 68374758, Email: caaa@bia701.com, Web site: <http://www.bia701.com>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Subsonic

China

Installation Name	Test Section Size	Speed Range
China Aerodynamics Research and Development Center (CARD C), Mianyang City, Sichuan Province, China	#1: 12 x 16 m; #2: 8 x 6 m	#1: up to 0.07 Mach; #2: up to 0.30 Mach
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	Atmospheric
<b>Facility Name</b>	1979	<b>Reynolds Number (million)</b>
Large Low Speed Wind Tunnel	<b>Cost</b>	#1: 1.7, #2: 6.9
		<b>Dynamic Pressure</b>
	<b>Operational Status</b>	
	Presumed active as of November 2005	<b>Stagnation Pressure</b>
		Atmospheric

## Supplementary Technical Parameters

Larger test section has a 2-D contraction ratio of 2.5:1. A 3-D contraction ratio of 4:1 between the test sections gives a total CR+10 for the smaller test section. Powered by three fans, 7800 kW total.

## Data Acquisition

## Testing Capabilities/Current Programs

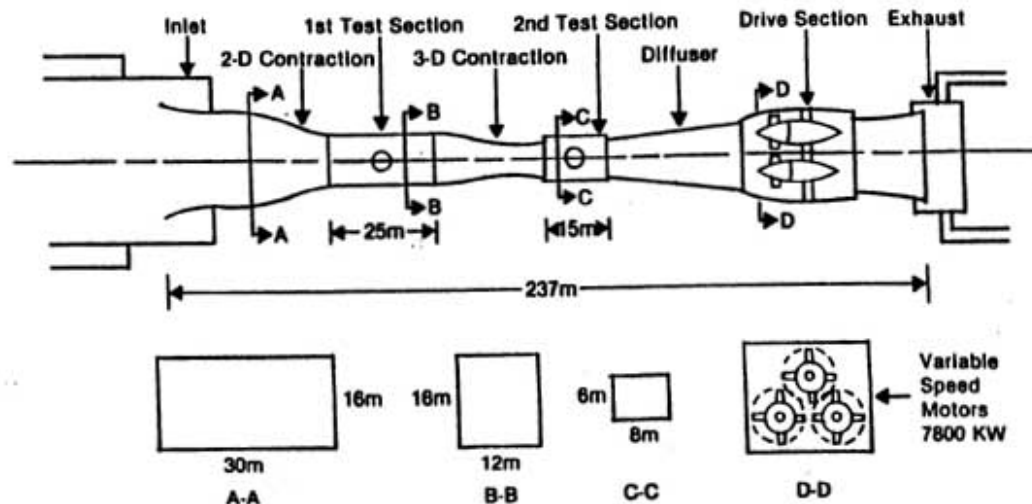
## Planned Improvements

## User Fees

## Contact Information

Shang Shouhong (Dean), China Aerodynamics Research and Development Center Graduate School, PO Box 211, Mianyang City, Sichuan Province 621000, China. Tel: (86) 816 246 3053, Fax: (86) 816 246 3051, Email: ssh@cardcgs.com, Web site: <http://www.cardcgs.com/cardcgs/index.asp> or <http://www.cardcgs.com/default2.asp>.

## European and Asian Wind Tunnels



**Open-circuit low-speed wind tunnel (two test sections) at the Low-Speed Aerodynamic Research Institute near Mianyang**

Figure 4.1-3 CARDC Large Low Speed Wind Tunnel (12 x 16/ 8 x 6)

**Large Low-Speed Wind Tunnel, China Aerodynamics Research and Development Center (CARDC), Mianyang, China.**



# European and Asian Wind Tunnels

Subsonic

China

<b>Installation Name</b>	<b>Test Section Size</b>	<b>Speed Range</b>
China Aerodynamics Research and Development Center (CARD C), Mianyang City, Sichuan Province, China	55 m (height), 5 m (diameter)	up to 50 m/s
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	
<b>Facility Name</b>	2005	<b>Reynolds Number (million)</b>
Large-Scale Vertical Wind Tunnel	<b>Cost</b>	
		<b>Dynamic Pressure</b>
	<b>Operational Status</b>	<b>Stagnation Pressure</b>
	Presumed active as of November 2005	

## Supplementary Technical Parameters

China's first domestically designed and built vertical wind tunnel.

## Data Acquisition

## Testing Capabilities/Current Programs

Research on aircraft speed loss and tailspin and aerodynamic stability of satellites and manned spacecraft during recovery operations.

## Planned Improvements

## User Fees

## Contact Information

Shang Shouhong (Dean), China Aerodynamics Research and Development Center Graduate School, PO Box 211, Mianyang City, Sichuan Province 621000, China.  
Tel: (86) 816 2463053, Fax: (86) 816 2463051, Email: [ssh@cardcgs.com](mailto:ssh@cardcgs.com), Web site: <http://www.cardcgs.com/cardcgs/index.asp>,  
<http://www.cardcgs.com/default2.asp>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Subsonic

China

<b>Installation Name</b>	<b>Test Section Size</b>	<b>Speed Range</b>
China Aerodynamics Research and Development Center (CARD C), Mianyang City, Sichuan Province, China	4 x 3 m	100 m/s
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	Atmospheric
<b>Facility Name</b>	mid to late 1970s	<b>Reynolds Number (million)</b>
Low Speed Wind Tunnel	<b>Cost</b>	6
		<b>Dynamic Pressure</b>
	<b>Operational Status</b>	
	Presumed active as of November 2005	<b>Stagnation Pressure</b>
		Atmospheric

## Supplementary Technical Parameters

Closed circuit, continuous flow, atmospheric.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Shang Shouhong (Dean), China Aerodynamics Research and Development Center Graduate School, PO Box 211, Mianyang City, Sichuan Province 621000, China.  
Tel: (86) 816 246 3053, Fax: (86) 816 246 3051, Email: ssh@cardcgs.com, Web site: <http://www.cardcgs.com/cardcgs/index.asp>,  
<http://www.cardcgs.com/default2.asp>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Subsonic

China

Installation Name	Test Section Size	Speed Range
Chinese Aerodynamics Research Institute of Aeronautics (CARIA), Harbin, Heilongjiang Province, China	1.5 m (diameter)	50 m/s (max)
		Temperature Range
	Date Built/Upgrade	
Facility Name	1995	Reynolds Number (million)
FL-5 Low Speed Wind Tunnel	Cost	
		Dynamic Pressure
	Operational Status	
	Presumed active as of November 2005	Stagnation Pressure

## Supplementary Technical Parameters

Circular aperture, single return.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Professor Yu Tao (Director), Chinese Aerodynamic Research Institute of Aeronautics (CARIA), PO Box 88, 2 Yiman Street, Harbin, Heilongjiang Province, 15000 China.

Tel: (86) 451 82539364, Fax: (86) 451 82838327, Email: [cph@caria.com.cn](mailto:cph@caria.com.cn), Web site: <http://www.caria.com.cn>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Subsonic

China

<b>Installation Name</b>	<b>Test Section Size</b>	<b>Speed Range</b>
Chinese Aerodynamics Research Institute of Aeronautics (CARIA), Harbin, Heilongjiang Province, China	3.5 x 2.5 m	up to 73 m/s
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	
<b>Facility Name</b>	1963	<b>Reynolds Number (million)</b>
FL-8 Low Speed Wind Tunnel	<b>Cost</b>	
		<b>Dynamic Pressure</b>
	<b>Operational Status</b>	<b>Stagnation Pressure</b>
	Presumed active as of November 2005	

## Supplementary Technical Parameters

Closed circuit, flat, octagonal-shaped test section.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Professor Yu Tao (Director), Chinese Aerodynamic Research Institute of Aeronautics (CARIA), PO Box 88, 2 Yiman Street, Harbin, Heilongjiang Province, 150001 China.

Tel: (86) 451 82539364, Fax: (86) 451 82838327, Email: cph@caria.com.cn, Web site: <http://www.caria.com.cn>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**



# European and Asian Wind Tunnels

Subsonic

China

<b>Installation Name</b>	<b>Test Section Size</b>	<b>Speed Range</b>
Chinese Aerodynamics Research Institute of Aeronautics (CARIA), Harbin, Heilongjiang Province, China	4.5 x 3.5 m	
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	
<b>Facility Name</b>	Scheduled for completion in 2006	<b>Reynolds Number (million)</b>
FL-9 Low Speed Continuous Pressurized Wind Tunnel		up to 8.5 (per meter)
	<b>Cost</b>	<b>Dynamic Pressure</b>
		0.4 Mpa
	<b>Operational Status</b>	<b>Stagnation Pressure</b>
	Under construction	

## Supplementary Technical Parameters

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Professor Yu Tao (Director), Chinese Aerodynamic Research Institute of Aeronautics (CARIA), PO Box 88, 2 Yiman Street, Harbin, Heilongjiang Province, 150001 China.

Tel: (86) 451 82539364, Fax: (86) 451 82838327, Email: cph@caria.com.cn, Web site: <http://www.caria.com.cn>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Subsonic

China

Installation Name	Test Section Size	Speed Range
Chung Cheng Institute of Technology, Rotating Fluids and Vortex Dynamics Lab, Taiwan, China	400 x 400 mm	
		Temperature Range
	Date Built/Upgrade	
Facility Name		Reynolds Number (million)
Open Loop Low Speed Wind Tunnel	Cost	
		Dynamic Pressure
	Operational Status	
	Presumed active as of August 2002	Stagnation Pressure

## Supplementary Technical Parameters

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Dr. Pei-Yuan Tzeng (Director), Rotating Fluids & Vortex Dynamics Lab (RFD), Chung Cheng Institute of Technology, No. 190, Sanyuan 1st St., Tahsi, Taoyuan, Taiwan 33509, China.

Tel: (886) 33 800960, Fax: (886) 33 891519, Email: pytzeng@ccit.edu.tw, Web site: <http://www.ccit.edu.tw/~RFVDFLab/>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Subsonic

China

Installation Name	Test Section Size	Speed Range
Nanjing University of Aeronautics and Astronautics (NUAA), Nanjing, Jiangsu Province, China	#1: 5.1 x 4.25 m; #2: 3.0 x 2.5 m	#1: 30 m/s; #2: 90 m/s
		Temperature Range
	Date Built/Upgrade	
Facility Name		Reynolds Number (million)
Large-Scale Dual-Test Section Low Speed Wind Tunnel	Cost	#1: 1.8, #2: 5.4
		Dynamic Pressure
	Operational Status	
	Presumed active as of November 2005	Stagnation Pressure

## Supplementary Technical Parameters

## Data Acquisition

## Testing Capabilities/Current Programs

Can be used as a low-turbulence wind tunnel, three-dimensional smoke wind tunnel, water tunnel, and jet flow test device. Used as six-component force and pressure measurements on airplane models. Also used to test wind loads on buildings, bridges, radar antennas, and television towers, and aerodynamic performance of windmills.

## Planned Improvements

## User Fees

## Contact Information

Professor Xu Xiwu (Dean), College of Aerospace Engineering, Nanjing University of Aeronautics and Astronautics, 29 Yudao Street, Jiangsu Province, Nanjing 210016, China.

Tel: (86) 25 8489 3212, Tel (Dean): (86) 25 84891585, Fax: (86) 25 8489 1512, Email: office@nuaa.edu.cn; Email (Dean): xwxu@nuaa.edu.cn, Web site: <http://www.nuaa.edu.cn>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Subsonic

China

Installation Name	Test Section Size	Speed Range
Northwestern Polytechnical University (NWPU, NPU), Xi'an, Shaanxi Province, China	#1: 3 x 1.6 m (2-D); #2: 3.5 x 2.5 m (3-D); #3: 2.2 m (diameter) (propeller test section)	#1: 130 m/s (max); #2: 90 m/s; #3: 145 m/s (max)
		Temperature Range
	Date Built/Upgrade	
Facility Name	2002 or 2005	Reynolds Number (million)
NF-3 Low Speed Airfoil Wind Tunnel		#1: 7; #2: 5; #3: N/A
	Cost	Dynamic Pressure
	Operational Status	Stagnation Pressure
	Presumed active as of November 2005	Atmospheric

## Supplementary Technical Parameters

Asia's largest low-speed, air-foil wind tunnel. China's only low-speed wind tunnel with interchangeable test sections. The 2-D test section has a turbulence intensity of less than 0.05%. The 3-D test section can perform full-scale tests. The propeller test section is China's only propeller test section that can simulate the advance ratio and the Mach number of the propeller tip simultaneously.

## Data Acquisition

Distributed control system: PSI8400 pressure measurement system, three-dimensional laser velocimeter, hotwire anemometer, infrared imager to measure flow transition, and automatic calibration of pressure and balance.

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Northwestern Polytechnical University, School of Aeronautics, State Key Laboratory for Airfoil and Cascade Aerodynamics, No.127 West Youyi Road, Xi'an City, Shaanxi Province, 710072, China.

Tel: (86) 29 8492222, Fax: (86) 29 8491000, Web site: <http://www.nwpu.edu.cn>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**



# European and Asian Wind Tunnels

Subsonic

China

Installation Name	Test Section Size	Speed Range
State Key Laboratory of Turbulence and Complex Systems (LTCS), Beijing University, Beijing, China	0.6 x 0.6 x 5 m	0.5 to 20 m/s
		Temperature Range
	Date Built/Upgrade	
Facility Name	Late 1980s	Reynolds Number (million)
Boundary Layer Wind Tunnel No. 1	Cost	
		Dynamic Pressure
	Operational Status	
	Presumed active as of November 2005	Stagnation Pressure

## Supplementary Technical Parameters

Direct-action type with temperature and velocity profilers.

## Data Acquisition

## Testing Capabilities/Current Programs

Basic research on turbulent boundary layers, flow separation, and vortex structures.

## Planned Improvements

## User Fees

## Contact Information

Professor She Zhensu (Director), State Key Laboratory of Turbulence and Complex Systems, Beijing University, Beijing 100871, China.  
Tel /Fax: (86) 10 62757944, Email: (Director) she@mech.pku.edu.cn, Email (Lab): ltcs@pku.edu.cn, Web site: <http://ltcs.pku.cn/cn>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Subsonic

China

Installation Name	Test Section Size	Speed Range
State Key Laboratory of Turbulence and Complex Systems (LTCS), Beijing University, Beijing, China	#1: 3.88 x 1.8 x 12 m; #2: 1.2 x 1 x 8 m	30 m/s (both test sections)
		Temperature Range
	Date Built/Upgrade	
Facility Name	Late 1980s	Reynolds Number (million)
Boundary Layer Wind Tunnel No. 2	Cost	
		Dynamic Pressure
	Operational Status	
	Presumed active as of November 2005	Stagnation Pressure

## Supplementary Technical Parameters

## Data Acquisition

## Testing Capabilities/Current Programs

Basic and applied research on environmental aerodynamics, especially experimental studies on simulating atmospheric boundary layers.

## Planned Improvements

## User Fees

## Contact Information

Professor She Zhensu (Director), State Key Laboratory of Turbulence and Complex Systems, Beijing University, Beijing 100871, China.  
Tel/Fax: (86) 10 62757944, Email (Director): she@mech.pku.edu.cn, Email (Lab): ltcs@pku.edu.cn, Web site: <http://ltcs.pku.cn/cn>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Subsonic

China

Installation Name	Test Section Size	Speed Range
State Key Laboratory of Turbulence and Complex Systems (LTCS), Beijing University, Beijing, China	2.25 m (diameter), 3.65 m (long)	55 m/s (max)
		Temperature Range
	Date Built/Upgrade	
Facility Name	1958	Reynolds Number (million)
Large-Scale Low Speed Wind Tunnel	Cost	
		Dynamic Pressure
	Operational Status	
	Presumed active as of November 2005	Stagnation Pressure

## Supplementary Technical Parameters

Open circuit, circular test section.

## Data Acquisition

## Testing Capabilities/Current Programs

When it was first built in 1958, it was China's largest low-speed wind tunnel at the time and it was used for research and development of aircraft. In the 1970s it was used for simulating atmospheric boundary layers. Recently it has been used to conduct basic experiments to develop a theory of scale laws for turbulent layer gradations.

## Planned Improvements

## User Fees

## Contact Information

Professor She Zhensu (Director), State Key Laboratory of Turbulence and Complex Systems, Beijing University, Beijing 100871, China.  
Tel/Fax: (86) 10 62757944, Email (Director): she@mech.pku.edu.cn, Email (Lab): ltcs@pku.edu.cn, Web site: <http://ltcs.pku.cn/cn>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Subsonic

China

Installation Name	Test Section Size	Speed Range
State Key Laboratory of Turbulence and Complex Systems (LTCS), Beijing University, Beijing, China	0.3 x 0.8 x 3.2 m	0.3 to 23 m/s
		Temperature Range
	Date Built/Upgrade	
Facility Name	1983	Reynolds Number (million)
Low-Turbulence Wind Tunnel	Cost	
		Dynamic Pressure
	Operational Status	
	Presumed active as of November 2005	Stagnation Pressure

## Supplementary Technical Parameters

A suckdown-type wooden structure, contraction ratio of 18.25:1, motor power of 7.5 kW. The two-dimensional closed-end test section with its large contraction ratio, honeycombs, and fine-meshed, four-wall screens can reduce the turbulence degree to 0.085.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Professor She Zhensu (Director), State Key Laboratory of Turbulence and Complex Systems, Beijing University, Beijing 100871, China.  
Tel/Fax: (86) 10 62757944, Email (Director): she@mech.pku.edu.cn, Email (Lab): ltcs@pku.edu.cn, Web site: <http://ltcs.pku.edu.cn/>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**



# European and Asian Wind Tunnels

Subsonic

England

Installation Name	Test Section Size	Speed Range
Airbus, New Filton House, Bristol, England.	12 x 10 x 0 ft	
		Temperature Range
	Date Built/Upgrade	
Facility Name	1957/2004	Reynolds Number (million)
Airbus Filton Low Speed Wind Tunnel Facility	Cost	
		Dynamic Pressure
	Operational Status	
	Presumed active as of February 2006.	Stagnation Pressure

## Supplementary Technical Parameters

Closed, single return circuit, 1.6 MW power, 6-component load cell balance, and 217.0 mph maximum wind speed.

## Data Acquisition

SLA 7000 stereolithography system from 3D Systems Technology.

## Testing Capabilities/Current Programs

Aircraft, ground vehicles.

## Planned Improvements

Replacement of the current ageing control and data acquisition system, and improvements to the control room/tunnel and associated building works (as of November 2004).

## User Fees

## Contact Information

Alison Kearin, Filton-Airbus, Airbus, New Filton House, Filton, Bristol, BS99 7AR, England.  
Email: alison.kearin@airbus.com.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Subsonic

England

<b>Installation Name</b>	<b>Test Section Size</b>	<b>Speed Range</b>
BAE Systems Air Systems, Warton Aerodrome, Lancashire, England	12 x 10 x 25 ft (corner fillets)	0.25 Mach
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	Ambient to 45°C
<b>Facility Name</b>	1955	<b>Reynolds Number (million)</b>
Filton 12 x 10 ft Low Speed Wind Tunnel	<b>Cost</b>	1.4
		<b>Dynamic Pressure</b>
	<b>Operational Status</b>	
	Presumed active as of February 2006.	<b>Stagnation Pressure</b>
		Ambient

## Supplementary Technical Parameters

Solid construction, return circuit, fan-powered, Scanivalve or ZOC's for "steady" pressures, floor and rood balances, belt/suction/blowing ground effects, 280 psi and 3500 psi air supply systems, and four lbs/second air mass flow.

## Data Acquisition

IBM PC based, electro mechanical for forces and moments, dynamic signal acquisition and analysis by HP LMS sytem.

## Testing Capabilities/Current Programs

Aeronautics, ground transportation, buildings.

## Planned Improvements

## User Fees

## Contact Information

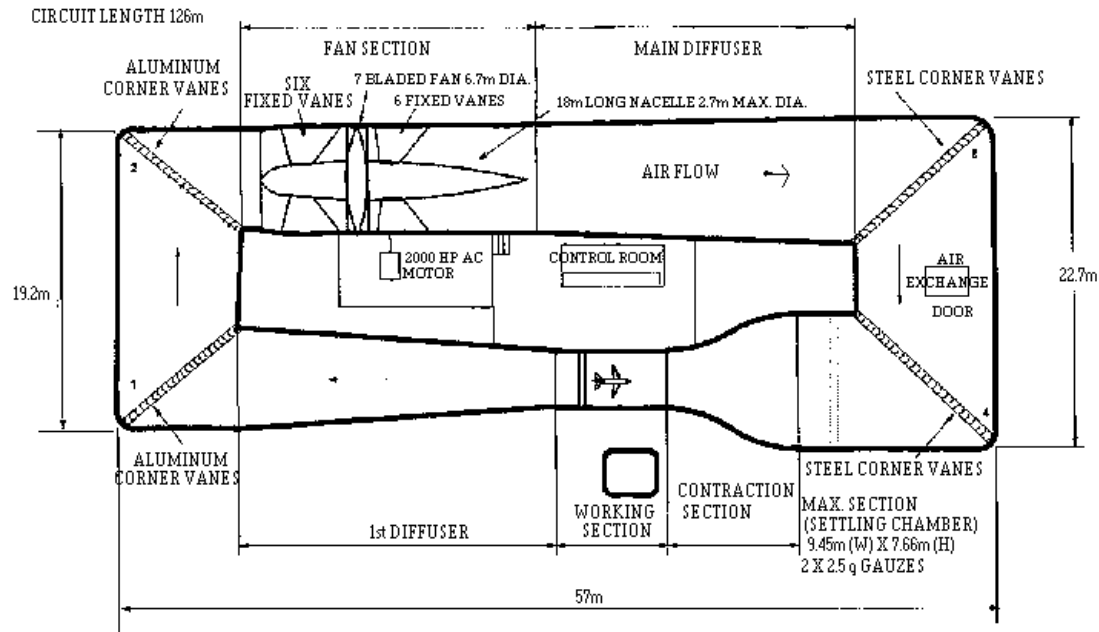
Paul Earnshaw, BAE Systems Air Systems, Warton Aerodrome, Preston, Lancashire PR4 1AX, United Kingdom.  
Tel: (44) 0 1772 855572, Email: paul.h.earnshaw@baesystems.com, Web site: <http://www.baesystems.com/programmes/airsystems/>.

# European and Asian Wind Tunnels

## BRITISH AEROSPACE AIRBUS LTD. - BRISTOL LOW SPEED WIND TUNNEL

MAX SPEED 91 m/s, 300 f/s, 203 m.p.h., 176 knots (0.28 MACH No.) (EMPTY TUNNEL)

CIRCUIT VOLUME 4545 m<sup>3</sup> (5.5 TONS OF AIR)



**Filton 12 x 10 ft Low Speed Wind Tunnel, BAE Systems Air Systems,  
Warton Aerodrome, Lancashire, England**

# European and Asian Wind Tunnels

Subsonic

England

Installation Name	Test Section Size	Speed Range
Department of Aerospace Engineering, University of Bristol, Bristol, England.	2.1 x 1.5 m octagonal section	60 m/s (max)
		Temperature Range
	Date Built/Upgrade	
Facility Name		Reynolds Number (million)
Large Low Speed Wind Tunnel	Cost	
		Dynamic Pressure
	Operational Status	
	Presumed active as February 2006.	Stagnation Pressure

## Supplementary Technical Parameters

Return section, 5.5 m x 2.6 m with a maximum speed of 12 m/s; used for rotor studies.

## Data Acquisition

## Testing Capabilities/Current Programs

Aerodynamics of aircraft, missiles, propellers, rotors and cars.

## Planned Improvements

## User Fees

## Contact Information

Department of Aerospace Engineering, University of Bristol, Bristol, University Walk, Bristol BS 8 1 TR, England.

Tel: (44) 117 928 7704, Tel (Dept office): (44) 117 33 17025, Fax: (44) 117 927 2771, Email (General Inquiries): [aero-office@bristol.ac.uk](mailto:aero-office@bristol.ac.uk), Web site:

<http://www.aer.bris.ac.uk/research/facilities.shtml>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Subsonic

England

Installation Name	Test Section Size	Speed Range
Department of Aerospace Engineering, University of Bristol, Bristol, England.	0.8 x 0.6 m (octagonal section)	100 m/s (max)
		Temperature Range
	Date Built/Upgrade	
Facility Name		Reynolds Number (million)
Low Turbulence Wind Tunnel	Cost	
		Dynamic Pressure
	Operational Status	Stagnation Pressure

## Supplementary Technical Parameters

Turbulence level 0.05%.

## Data Acquisition

## Testing Capabilities/Current Programs

Fundamental Fluid mechanics and Aerodynamics.

## Planned Improvements

## User Fees

## Contact Information

Department of Aerospace Engineering, University of Bristol, Bristol, University Walk, Bristol BS 8 1 TR, England.

Tel: (44) 117 928 7704, Tel (Dept. office): (44) 117 33 17025, Fax: (44) 117 927 2771, Email (General Inquiries): [aero-office@bristol.ac.uk](mailto:aero-office@bristol.ac.uk), Web site:

<http://www.aer.bris.ac.uk/research/facilities.shtml>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**



# European and Asian Wind Tunnels

Subsonic

England

<b>Installation Name</b>	<b>Test Section Size</b>	<b>Speed Range</b>
Department of Aerospace Engineering, University of Bristol, Bristol, England.	1.1 m (diameter)	40 m/s (max)
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	
<b>Facility Name</b>		<b>Reynolds Number (million)</b>
Open Jet Wind Tunnel	<b>Cost</b>	
		<b>Dynamic Pressure</b>
	<b>Operational Status</b>	<b>Stagnation Pressure</b>

## Supplementary Technical Parameters

## Data Acquisition

## Testing Capabilities/Current Programs

Aerofoil characteristics, vibration and oscillation studies.

## Planned Improvements

## User Fees

## Contact Information

Department of Aerospace Engineering, University of Bristol, Bristol, University Walk, Bristol BS 8 1 TR, England.  
 Tel: (44) 117 928 7704, Tel (Dept. office): (44) 117 33 17025, Fax: (44) 117 927 2771, Email (General Inquiries): [aero-office@bristol.ac.uk](mailto:aero-office@bristol.ac.uk), Web site:  
<http://www.aer.bris.ac.uk/research/facilities.shtml>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Subsonic

England

Installation Name	Test Section Size	Speed Range
Department of Aerospace Engineering, University of Bristol, Bristol, England.	0.6 x 0.6 m	35 m/s (max)
		Temperature Range
	Date Built/Upgrade	
Facility Name		Reynolds Number (million)
Open Return Low Speed Wind Tunnels (Two)	Cost	
		Dynamic Pressure
	Operational Status	
		Stagnation Pressure

## Supplementary Technical Parameters

## Data Acquisition

## Testing Capabilities/Current Programs

Teaching and student projects.

## Planned Improvements

## User Fees

## Contact Information

Department of Aerospace Engineering, University of Bristol, Bristol, University Walk, Bristol BS 8 1 TR, England.

Tel: (44) 117 928 7704, Tel (Dept office): (44) 117 33 17025, Fax: (44) 117 927 2771, Email: [aero-office@bristol.ac.uk](mailto:aero-office@bristol.ac.uk), Web site:

<http://www.aer.bris.ac.uk/research/facilities.shtml>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Subsonic

England

Installation Name	Test Section Size	Speed Range
Farnborough Air Sciences Trust (FAST), Berkshire, England	24 ft (7.3 m) (diameter)	up to 165 ft/s (50 m/s)
		Temperature Range
	Date Built/Upgrade	
Facility Name	1935/1992 (upgrade)	Reynolds Number (million)
No. 1 24-ft Low Speed Wind Tunnel (LST)	Cost	
		Dynamic Pressure
	Operational Status	
	Closed in 1996, may be re-opened for use. Prospective operators being solicited as of January	Stagnation Pressure

## Supplementary Technical Parameters

Open-jet, single-return circuit, continuous flow. This facility has a mahogany six-bladed fan powered by a 2000-hp, 750-V DC motor. At full speed this facility can run at 1.5 MVA.

## Data Acquisition

## Testing Capabilities/Current Programs

Full-size aircraft testing in 1930s; pitch behavior beyond stall for rear-engined aircraft (BAC111, VC10, Trident) testing in 1960s. Current testing includes: testing piston engines in their nacelles with propellers running, propeller noise research, nozzle noise testing, unmanned aircraft research, helicopter rotor testing, VTOL research, redesign of Britannia engine intakes to prevent engine cut-outs, parachute testing. Also used for testing conifers behavior, motorway barriers, full-size radar scanners and full-size cars

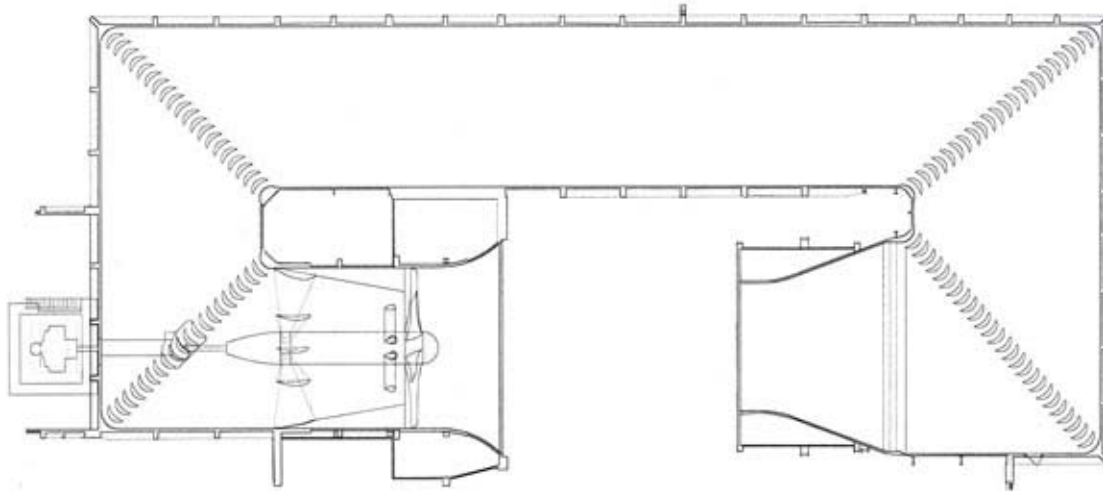
## Planned Improvements

## User Fees

## Contact Information

Stephen Lord (Senior Development Manager), Farnborough Air Sciences Trust, Slough Estates plc, 234 Bath Road, Slough, Berkshire SL1 4EE, England, UK.  
Tel: (44) 01753 213472, Email: Stephen.Lord@sloughestates.co.uk, Web site: <http://www.airsciences.org.uk/>.

## European and Asian Wind Tunnels



**No. 1 24-ft Low-Speed Wind Tunnel, Farnborough Air Sciences Trust (FAST), Berkshire, England.**

# European and Asian Wind Tunnels

Subsonic

England

Installation Name	Test Section Size	Speed Range
Farnborough Air Sciences Trust (FAST), Berkshire, England	3.4 x 2.6 x 6.1 m	200 ft/s (60 m/s) (max w/o cooling); 300 ft/s (90 m/s) (max @ 1.25MVA)
		Temperature Range
	Date Built/Upgrade	
Facility Name	1942/1970 (upgrade)	Reynolds Number (million)
No. 2 Low Speed Wind Tunnel (LST)		
	Cost	Dynamic Pressure
	Refurbishment estimate available upon request.	
	Operational Status	Stagnation Pressure
	Inactive since 1998. Prospective operators being solicited as of January 2006.	

## Supplementary Technical Parameters

This facility has a three-component roof balance, six-component floor balance, sting support  $-10^{\circ}$   $+30^{\circ}$  of incidence, with a maximum speed at 1.25 MVA.

## Data Acquisition

## Testing Capabilities/Current Programs

V/STOL research, including Harrier predecessors. Aircraft model tests. Combat aircraft research. Comet 3 wing tank development. Vortex flap research. Aircraft wake characteristics research. Swept wing stall behaviour research. Weapon systems research. Also used for oil cooler research for piston engines and testing of F1 racing cars, post office telegraph wires, bobsleighs, high-incidence canard delta tests, drag tests on Olympic skiers.

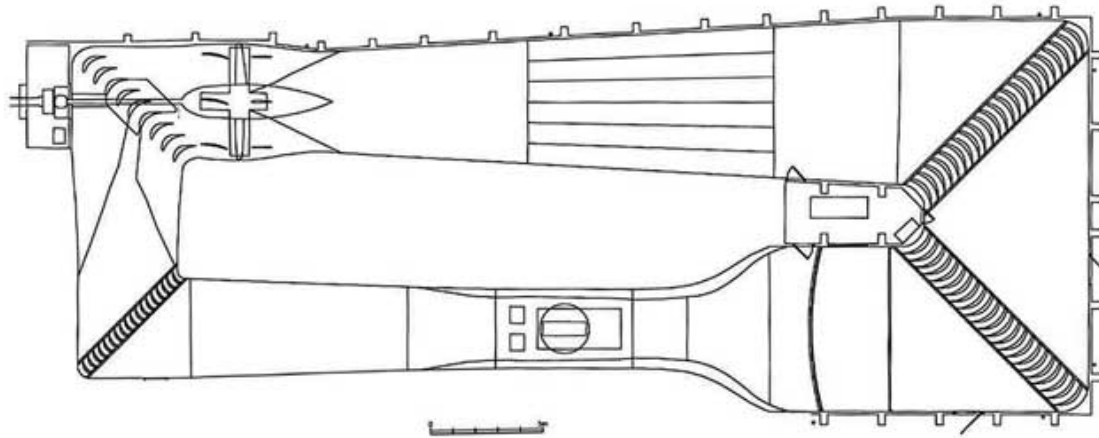
## Planned Improvements

## User Fees

## Contact Information

Stephen Lord (Senior Development Manager), Farnborough Air Sciences Trust, Slough Estates plc, 234 Bath Road, Slough, Berkshire SL1 4EE, England, UK.  
Tel: (44) 01753 213472, Email: Stephen.Lord@sloughstates.co.uk, Web site: <http://www.airsciences.org.uk/>.

## European and Asian Wind Tunnels



**No. 2 Low Speed Tunnel (LST), Farnborough Air Sciences Trust (FAST), Berkshire, England.**



# European and Asian Wind Tunnels

Subsonic

England

<b>Installation Name</b>	<b>Test Section Size</b>	<b>Speed Range</b>
Farnborough Air Sciences Trust (FAST), Berkshire, England	1.2 x 0.9 x 3.4 m	up to 280 ft/s (85 m/s)
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	
<b>Facility Name</b>	1946/1990 (upgrade)	<b>Reynolds Number (million)</b>
No. 3 Low Speed Wind Tunnel (LST)	<b>Cost</b>	
		<b>Dynamic Pressure</b>
	<b>Operational Status</b>	<b>Stagnation Pressure</b>
	Inactive since mid-1990s. Prospective operators being solicited as of January 2006.	

## Supplementary Technical Parameters

Continuous flow, closed circuit, octagonal cross section. The mahogany six-bladed fan is powered by a 200-hp DC motor. Has a three-component roof balance, traverse sting support, and contraction ratio of 32:1.

## Data Acquisition

## Testing Capabilities/Current Programs

Preliminary development work prior to investment in larger facilities. Research on boundary layer development and transition. High-performance glider wing sections. Development and calibration of aircraft instrumentation. Development of 2D testing techniques. Combat aircraft research. Vortex development research. Anemometer calibration. Testing of sharp edge M and W wings.

## Planned Improvements

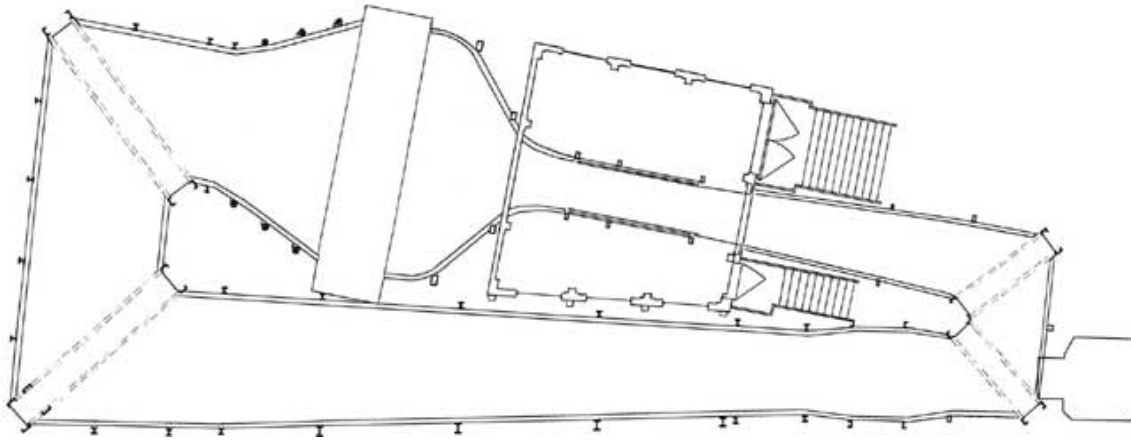
## User Fees

Because of its simplicity, safety and low operating costs this tunnel is also ideal for educational use.

## Contact Information

Stephen Lord (Senior Development Manager), Farnborough Air Sciences Trust, Slough Estates plc, 234 Bath Road, Slough, Berkshire SL1 4EE, England, UK.  
Tel: (44) 01753 213472, Email: Stephen.Lord@sloughstates.co.uk, Web site: <http://www.airsciences.org.uk/>.

## European and Asian Wind Tunnels



**No. 3 Low-Speed Wind Tunnel (LST), Farnborough Air Sciences Trust (FAST), Berkshire, England.**

# European and Asian Wind Tunnels

Subsonic

England

Installation Name	Test Section Size	Speed Range
Flow Science Limited, Goldstein Research Laboratory, Manchester, England	0.5 x 0.5 x 3.0 m	up to 42 m/s
		Temperature Range
	Date Built/Upgrade	
Facility Name		Reynolds Number (million)
0.5 x 0.5 m Low-Turbulence Wind Tunnel	Cost	
		Dynamic Pressure
	Operational Status	
	Presumed active as of October 2005	Stagnation Pressure

## Supplementary Technical Parameters

Closed return circuit, 20:1 contraction ratio, <0.03% turbulence level.

## Data Acquisition

## Testing Capabilities/Current Programs

The tunnel is ideally suited for detailed flow investigations in such areas as laminar flow studies on aircraft wings.

## Planned Improvements

## User Fees

## Contact Information

David Smith (Operations Director), Flow Science Limited, Goldstein Research Laboratory, Barton Airport Eccles, Manchester M 30 7RU, England, UK.  
Tel/Fax: (44) 0161 787 8749, Email (Smith): david@fs1.ae.man.ac.uk, Email (General): Flowsci@fs1.ae.man.ac.uk, Web site:  
<http://www.flow-science.eng.man.ac.uk/etdetail.htm>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Subsonic

England

Installation Name	Test Section Size	Speed Range
Flow Science Limited, Goldstein Research Laboratory, Manchester, England	1.35 x 0.95 m	40 m/s (open jet), 50 m/s (closed)
		Temperature Range
	Date Built/Upgrade	
Facility Name		Reynolds Number (million)
1.35 x 0.95 m Blow-down Wind Tunnel	Cost	
		Dynamic Pressure
	Operational Status	
	Presumed active as of October 2005.	Stagnation Pressure

## Supplementary Technical Parameters

Blow down to open jet or closed working section with diffuser. Test section turbulence level < 0.6%, flow velocity variation <0.2%. Double inlet centrifugal fan, 1.3 m diameter with 50-kW drive via magnetic clutch, two 1.0-q and three 2.0-q screens, 6:1 contraction ratio.

## Data Acquisition

Traverse gear, scanivalves, pressure transducers, custom made 5 and 7-hole pitot probes can be used to measure flow angles and speeds, hot wire probes, digital oscilloscopes, digital spectrum analyser for recording transient, unsteady or fluctuating flows or responded.

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

David Smith (Operations Director), Flow Science Limited, Goldstein Research Laboratory, Barton Airport Eccles, Manchester M 30 7 RU England.  
Tel/Fax: (44) 0161 787 8749, Email (Director): david@fs1.ae.man.ac.uk, Email (General): Flowsci@fs1.ae.man.ac.uk, Web site:  
<http://www.flow-science.eng.man.ac.uk/etdetail.htm>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Subsonic

England

<b>Installation Name</b>	<b>Test Section Size</b>	<b>Speed Range</b>
Flow Science Limited, Goldstein Research Laboratory, Manchester, England	2.75 x 2.23 x 5.5 m	up to 70 m/s (max)
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	
<b>Facility Name</b>	1950s/1989 (acquired from British Aerospace, moved, refurbished)	<b>Reynolds Number (million)</b>
AVRO 9 x 7 ft Low Speed Wind Tunnel	<b>Cost</b>	
		<b>Dynamic Pressure</b>
	<b>Operational Status</b>	
	Presumed active as of October 2005	<b>Stagnation Pressure</b>

## Supplementary Technical Parameters

Closed return, occupying 39 x 15 meters floor space. Turbulence level of below 0.1%, honeycomb, two 1.2-q screens, 5:1 contraction ratio.

## Data Acquisition

Scanivalves, pressure transducers, custom made 5 and 7-hole pitot probes can be used to measure flow angles and speeds, thermocouples, hot wire probes, digital oscilloscopes, digital spectrum analyser for recording transient, unsteady or fluctuating flows or responses, flow visualisation using tufts, fluorescent mini-tufts,

## Testing Capabilities/Current Programs

The facility is used extensively by industry, government agencies, and research establishments for obtaining aerodynamic performance data of scale-model flight and surface vehicles

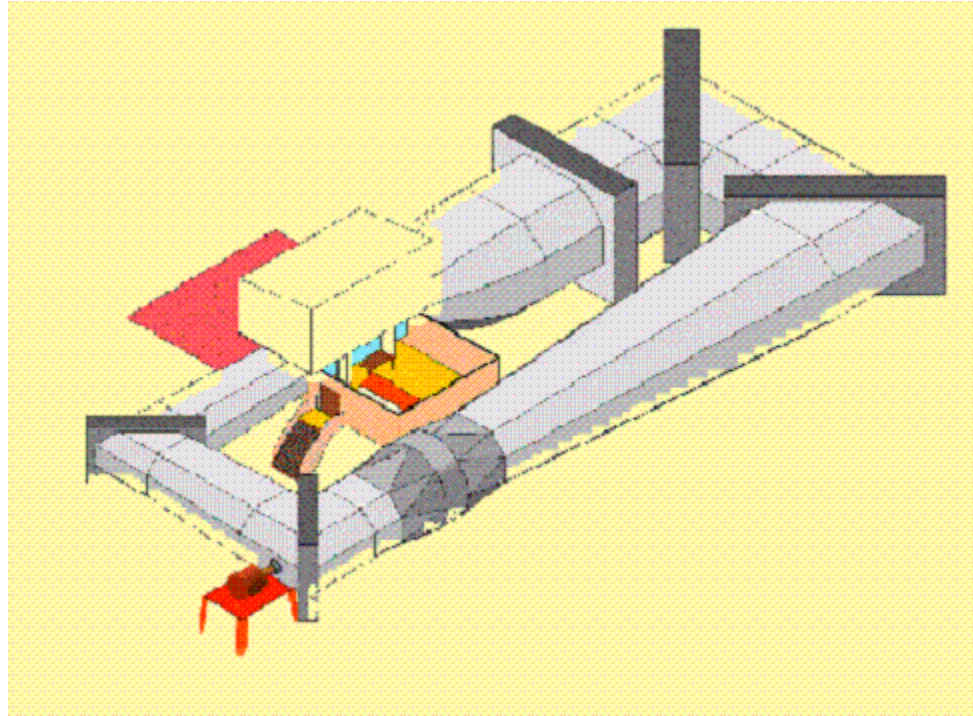
## Planned Improvements

## User Fees

## Contact Information

David Smith (Operations Director), Flow Science Limited, Goldstein Research Laboratory, Barton Airport Eccles, Manchester M 30 7RU, England, UK.  
Tel/Fax: (44) 0161 787 8749, Email (Smith): david@fs1.ae.man.ac.uk, Email (General): Flowsci@fs1.ae.man.ac.uk, Web site:  
<http://www.flow-science.eng.man.ac.uk/etdetail.htm>.

## European and Asian Wind Tunnels



**AVRO 9 x 7 ft Low-Speed Wind Tunnel, Flow Science Limited, Goldstein Research Laboratory, Manchester, England.**



# European and Asian Wind Tunnels

Subsonic

England

<b>Installation Name</b>	<b>Test Section Size</b>	<b>Speed Range</b>
QinetiQ, Farnborough, England	4.2 x 5.0 x 8 m	0.05 to 0.34 Mach
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	Ambient
<b>Facility Name</b>	1977/continuous rolling refurbishment program	<b>Reynolds Number (million)</b>
5 m Low Speed Wind Tunnel	<b>Cost</b>	7.6
		<b>Dynamic Pressure</b>
	<b>Operational Status</b>	
	Presumed active as of January 2006	<b>Stagnation Pressure</b>
		3.0 bar

## Supplementary Technical Parameters

Closed, single return. Solid construction with tapered fillets, 13.6 MW maximum power (A.C. and D.C). PSI (8400 and ESP) pressure system. Two underfloor and various strain gauge balances. Variable height ground effects air supply. 100 bar air supply system. 8 kg/sec continuous 32 kg/sec for 6 minutes air mass flow.

## Data Acquisition

DEC-Alpha/Vax, various

## Testing Capabilities/Current Programs

Modelling landing and take-off performance for civil and military aircraft. Also comes into its own with other tests applications on high-speed trains to rotor blades, radar to a range of aerofoil structures.

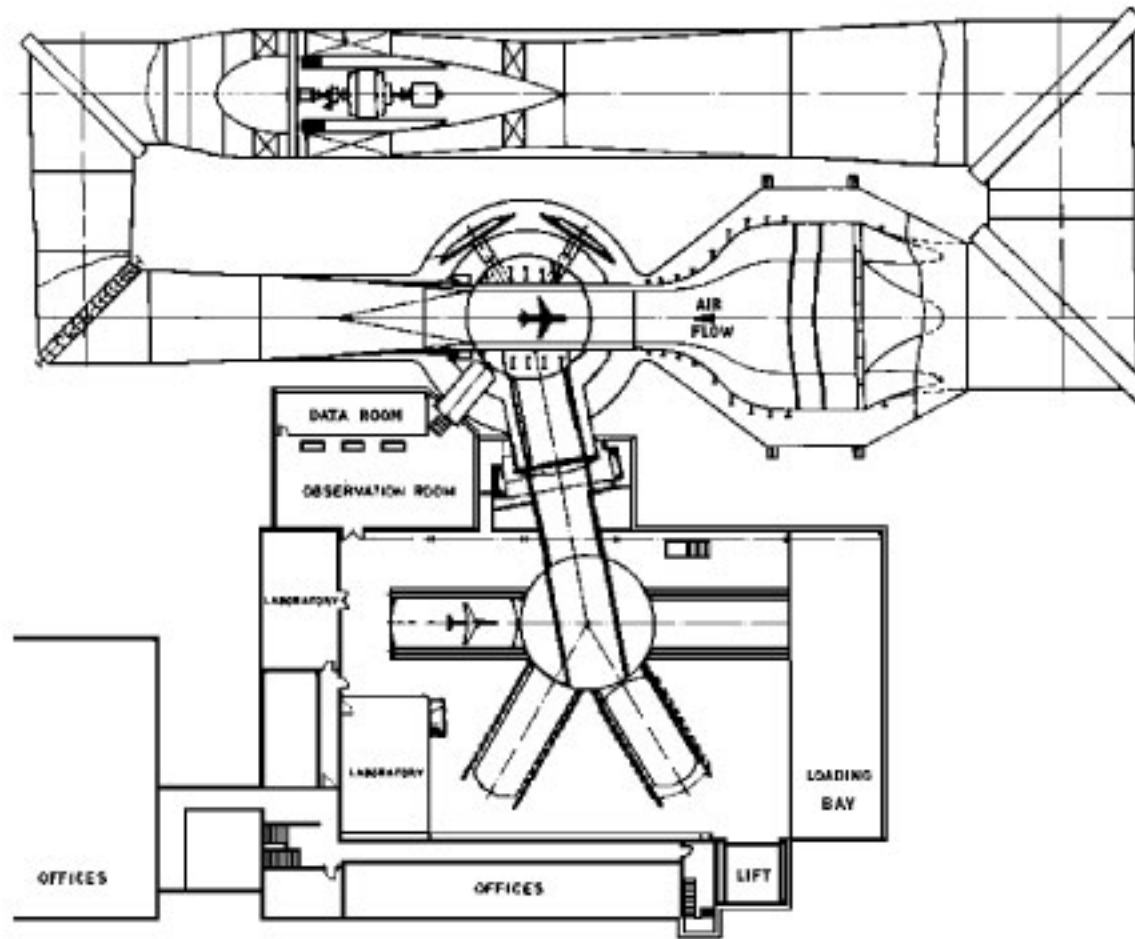
## Planned Improvements

## User Fees

## Contact Information

QinetiQ, QinetiQ Customer Contact Team, Cody Technology Park, Ively Road, Farnborough Hampshire, GU 14 0LX, England, UK.  
Tel: (44) 0 1252 392000, Fax: (44) 0 1252 393399, Web site: <http://www.qinetiq.com>.

## European and Asian Wind Tunnels



**5 meter Low-Speed Wind Tunnel, QinetiQ, Farnborough, England.**

# European and Asian Wind Tunnels

Subsonic

France

Installation Name	Test Section Size	Speed Range
CEPr and ONERA, Center for Engine Testing (CEPr), Saclay, France	#1: 2 m (open jet); #2: 3 m (open jet)	#1: 120 m/s; #2: 60 m/s
		Temperature Range
	Date Built/Upgrade	#1: 877°C; #2: 227°C
Facility Name	1976/1999	Reynolds Number (million)
CEPRA 19 Anechoic Wind Tunnel	Cost	#1: 1.3; #2: 0.8
		Dynamic Pressure
	Operational Status	
	Presumed active as of September 2005	Stagnation Pressure

## Supplementary Technical Parameters

Open circuit, continuous atmospheric, aero-acoustic windtunnel. 7-MWA 12 x 9 m inlet featuring a dust filter, acoustic baffles, anti-turbulence screens and a honeycomb. Nozzle with 9-m diameter inlet, 2- or 3-m diameter outlet. Anechoic chamber roughly a quarter of a sphere, internal radius of 9.6 m. Flow collector fan silencer centrifugal fan driven by 7-MW asynchronous electric motor.

## Data Acquisition

## Testing Capabilities/Current Programs

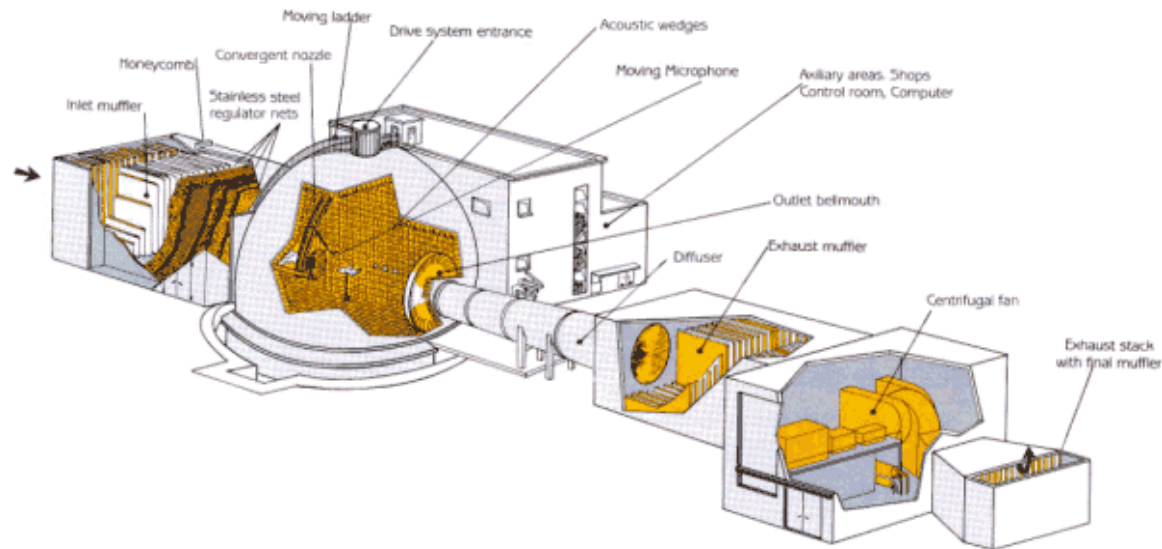
## Planned Improvements

## User Fees

## Contact Information

Olivier Piccin (CEPRA19 Manager), Centre d'Essais des Propulseurs (CEPr), Saclay, France.  
Tel: (33) 1 60 19 67 85, Fax: (33) 1 46 73 41 44, Email: [Olivier.Piccin@onera.fr](mailto:Olivier.Piccin@onera.fr), Web site: <http://www.onera.fr/gmt-en/wind-tunnels/cepra19.html>,  
<http://www.onera.fr/gmt-en/table.html>.

# European and Asian Wind Tunnels



**CEPRA 19 Anechoic Wind Tunnel, ONERA French Aeronautics and Space Research Center, Saclay, France.**

# European and Asian Wind Tunnels

Subsonic

France

Installation Name	Test Section Size	Speed Range
French-German Research Institute of Saint Louis (ISL), Saint Louis, France	90 x 70 x 80 cm	0.126 Mach
		Temperature Range
	Date Built/Upgrade	
Facility Name		Reynolds Number (million)
S20 Subsonic Wind Tunnel	Cost	
		Dynamic Pressure
	Operational Status	
	Presumed active as of September 2005	Stagnation Pressure

## Supplementary Technical Parameters

Measurements taken include shadow or Schlieren photography, measurement of steady and transient pressures, force and moment measurements using wind tunnel balance, laser Doppler velocimetry, particle image velocimetry, Doppler picture technique, and visualization by means of holographic filters.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

French-German Research Institute of Saint-Louis (ISL), 5 rue du Général Cassagnou, 68300 Saint-Louis, France.

Mailing address: ISL, PO Box 70034, FR 68301 Saint Louis CEDEX.

Tel: (33) 3 89 69 50 00, (33) 3 89 69 50 02, Email: isl@isl.tm.fr, Web site: [http://www.isl.tm.fr/en/generalite/intro\\_pres\\_e.html](http://www.isl.tm.fr/en/generalite/intro_pres_e.html).

## European and Asian Wind Tunnels



**S20 Subsonic Wind Tunnel, French-German Institute of Saint Louis, St Louis, France.**

# European and Asian Wind Tunnels

Subsonic

France

Installation Name	Test Section Size	Speed Range
ONERA French Aeronautics and Space Research Center, Le Fauga Mauzac Center, Le Fauga Mauzac, France	4 model-carts: 4.5 x 3.5 m each	123 m/s (0.36 Mach)
		Temperature Range
	Date Built/Upgrade	
Facility Name	1974	Reynolds Number (million)
F1 Continuous Pressurized Subsonic Wind Tunnel	Cost	8
		Dynamic Pressure
	Operational Status	
	Presumed active as of September 2005	Stagnation Pressure
		1 to 3.85 bar

## Supplementary Technical Parameters

Internal balances: 80 available balances; special design on request. Wall balance may be equipped with high-pressure air crossing for turbine supply (propane or turbofan simulation). Turbine simulators for propellers. High-pressure air supply: mass flow up to 20 kg/s, pressure up to 120 bars, temperature up to 80°C. Rigs for propeller calibration tests, TPS, air intake, probing device for flow surveys around models. Boundary layer control by blowing on the floor for ground effect tests.

## Data Acquisition

Flow visualization by laser sheet, colored oils, mini-tufts with UV light, transition visualization by acenaphthene sublimation or infrared camera.

## Testing Capabilities/Current Programs

Propellar calibration tests.

## Planned Improvements

## User Fees

## Contact Information

Jean-Claude Traineau (Director), Le Fauga-Mauzac Wind Tunnel Department, ONERA, Centre du Fauga-Mauzac, F-31410 NOE, France.  
Tel: (33) 5 61 56 63 01, Fax: (33) 5 61 56 63 63, Email: Jean-Claude.Traineau@onera.fr, Web site: <http://www.onera.fr/gmt-en/wind-tunnels/cepra19.html>,  
<http://www.onera.fr/gmt-en/table.html>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**



# European and Asian Wind Tunnels

Subsonic

France

<b>Installation Name</b>	<b>Test Section Size</b>	<b>Speed Range</b>
ONERA French Aeronautics and Space Research Center, Le Fauga Mauzac Center, Le Fauga Mauzac, France	1.4 x 1.8 m	up to 100 m/s
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	± 1°C ???
<b>Facility Name</b>	1974	<b>Reynolds Number (million)</b>
F2 Continuous Atmospheric Subsonic Wind Tunnel	<b>Cost</b>	1.1
		<b>Dynamic Pressure</b>
	<b>Operational Status</b>	<b>Stagnation Pressure</b>
	Presumed active as of September 2005	

## Supplementary Technical Parameters

## Data Acquisition

## Testing Capabilities/Current Programs

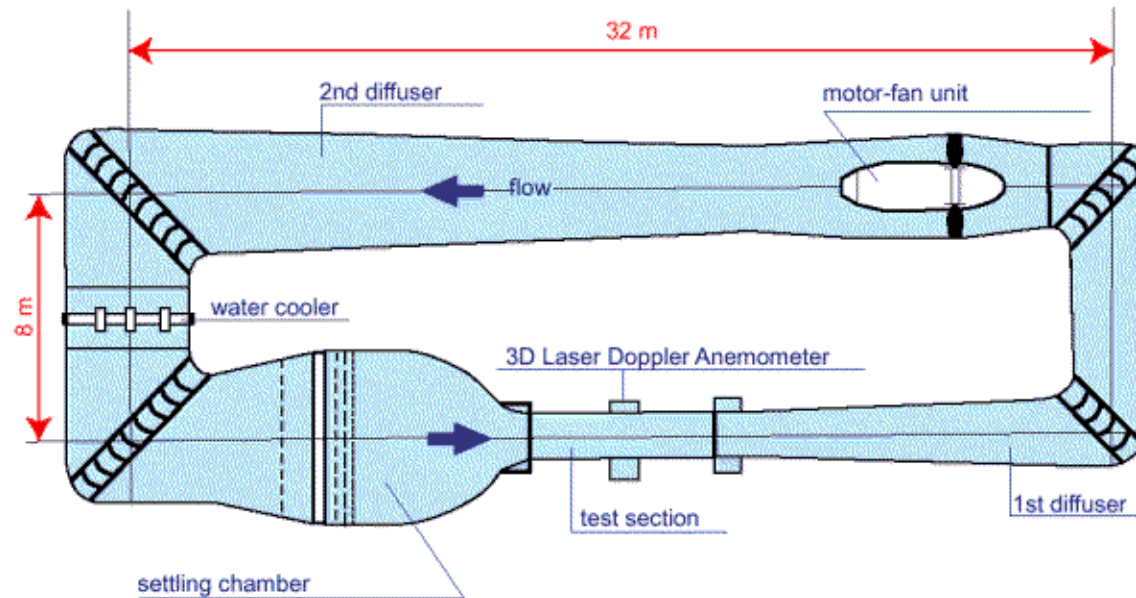
## Planned Improvements

## User Fees

## Contact Information

Philippe Loiret (Installation Head), Jean-Claude Raynal (Chief), Wind Tunnel Research Unit, ONERA, Centre du Fauga-Mauzac, F-31410 NOE, France.  
 Tel (Loiret): (33) 5 61 56 63 73, Tel (Raynal): (33) 5 61 56 63 71, Email (Loiret): Philippe.Loiret @ onera.fr, Web site:  
<http://www.onera.fr/gmt-en/wind-tunnels/cepra19.html> or <http://www.onera.fr/gmt-en/table.html>.

## European and Asian Wind Tunnels



**F2 Continuous Atmospheric Wind Tunnel, ONERA French Aeronautics and Space Research Center, Fauga-Mauzac, France.**

# European and Asian Wind Tunnels

Subsonic

Germany

<b>Installation Name</b>	<b>Test Section Size</b>	<b>Speed Range</b>
Carolo-Wilhelmina Technical University at Braunschweig, Institute for Fluid Mechanics (ISM), Braunschweig, Germany	600 x 400 x 1500 mm	19 m/s
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	
<b>Facility Name</b>		<b>Reynolds Number (million)</b>
Low Noise Low Speed Wind Tunnel (LNB)	<b>Cost</b>	low
		<b>Dynamic Pressure</b>
	<b>Operational Status</b>	<b>Stagnation Pressure</b>
	Presumed active as of November 2005	

## Supplementary Technical Parameters

The LNB is a continuous, atmospheric, Eiffel-type wind tunnel with a closed test section. It is driven by a 3-kW motor in suction mode. It has a rectangular cross section with a burger-type axial area. The contraction ratio is 16. Air passes through a 30-mm thick fleece mat followed by a honeycomb with a length of 133 mm.

## Data Acquisition

Stereo-scopic-PIV, Multiplane-PIV and Time-Resolved PIV techniques.

## Testing Capabilities/Current Programs

Research in low Reynolds number and unsteady aerodynamics, detailed flow investigations of laminar separation bubbles and interaction of coherent flow structures in turbulent boundary layers. Experiments on flapping wings at low Reynolds numbers also planned.

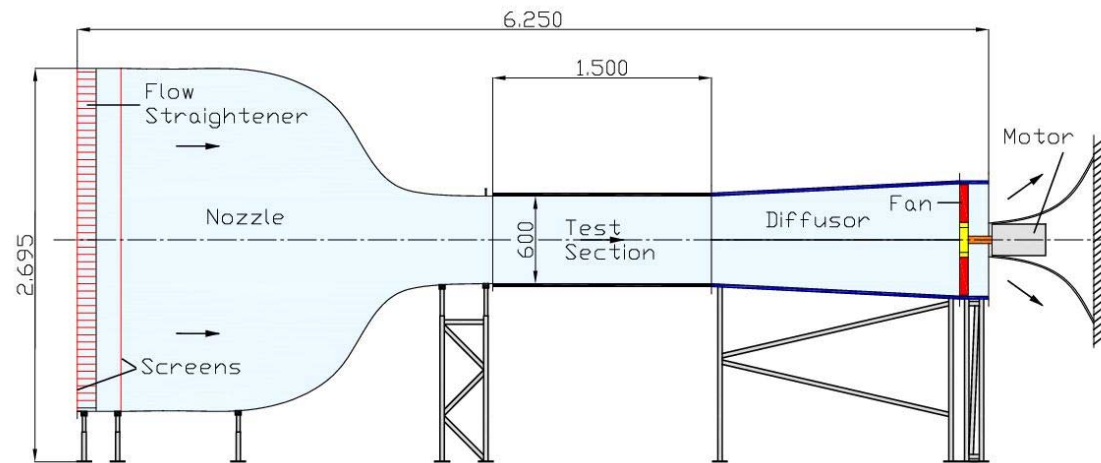
## Planned Improvements

## User Fees

## Contact Information

Dr. Christian Käehler, Department of Mechanical Engineering, Institut für Strömungsmechanik, Bienroder Weg, 338106 Braunschweig, Germany.  
Tel: (49) 531 391 2971, Fax: (49) 531 391 5952, Email: ckäehler@tu-braunschweig.de, Web site: <http://www.tu-braunschweig.de/ism/institut/wkanlagen/hlb>.

## European and Asian Wind Tunnels



**Low Noise, Low Speed Wind Tunnel (LNB), Carolino-Wilhelmina Technical University at Braunschweig (ISM), Braunschweig, Germany.**

# European and Asian Wind Tunnels

Subsonic

Germany

Installation Name	Test Section Size	Speed Range
Carolo-Wilhelmina Technical University at Braunschweig, Institute for Fluid Mechanics (ISM), Braunschweig, Germany	#1: 1300 x 1300 x 3000 mm; #2: 800 x 800 x 3000 mm	60 m/s (max)
		Temperature Range
	Date Built/Upgrade	10°C (max)
Facility Name		Reynolds Number (million)
Low Speed Wind Tunnel (MUB)		0.69
	Cost	Dynamic Pressure
	Operational Status	Stagnation Pressure
	Presumed active as of November 2005	

## Supplementary Technical Parameters

The MUB is a Göttinger-design closed-circuit atmospheric wind tunnel with three exchangeable measuring sections. The new heat exchanger in the calming chamber permits stable flow temperatures. It has flexible and optical measuring sections.

## Data Acquisition

8400 DTC pressure measuring system. 3-component PIV system, 340Hz of indigo infrared camera system research underway to develop infrared heat transfer measurements, two six-component balances, KME 4 external balance.

## Testing Capabilities/Current Programs

Research on airfoils, aircraft componets, and ground vehicles.

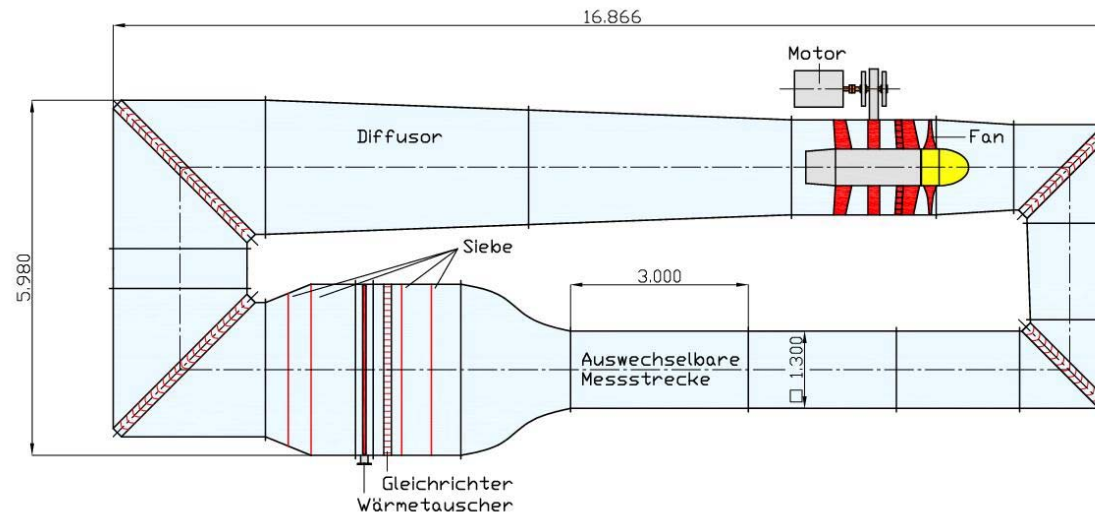
## Planned Improvements

## User Fees

## Contact Information

Dr. Thorsten Möller, Department of Mechanical Engineering, Institut für Strömungsmechanik (ISM), Bienroder Weg, 338106 Braunschweig, Germany.  
Tel: (49) 531 391 2971, Fax: (49) 531 391 5952, Email: t.möeller@tu-braunschweig.de, Web site: <http://www.tu-braunschweig.de/ism/institut/wkanlagen/hlb>.

## European and Asian Wind Tunnels



**Low-Speed Wind Tunnel (MUB), Carolo-Wilhelmina Technic University, University at Braunschweig, Institute for Fluid Mechanics (ISM), Braunschweig, Germany.**

# European and Asian Wind Tunnels

Subsonic

Germany

Installation Name	Test Section Size	Speed Range
Carolo-Wilhelmina Technical University at Braunschweig, Institute for Fluid Mechanics (ISM), Braunschweig, Germany	4997 x 2450 x 940 mm	65 m/s (max)
		Temperature Range
	Date Built/Upgrade	
Facility Name		Reynolds Number (million)
Small Wind Tunnel Braunschweig (KWB)	Cost	
		Dynamic Pressure
	Operational Status	
	Presumed active as of November 2005	Stagnation Pressure

## Supplementary Technical Parameters

The small wind tunnel is continuous with an open test section. It is driven by a 22-kW motor. The nozzle can be replaced with a burger-nozzle of bi-superelliptic shape. Has 505-mm open-jet diameter

## Data Acquisition

## Testing Capabilities/Current Programs

Educational. Used to investigate new measurement techniques and to study feasibility of new research concepts such as flow control.

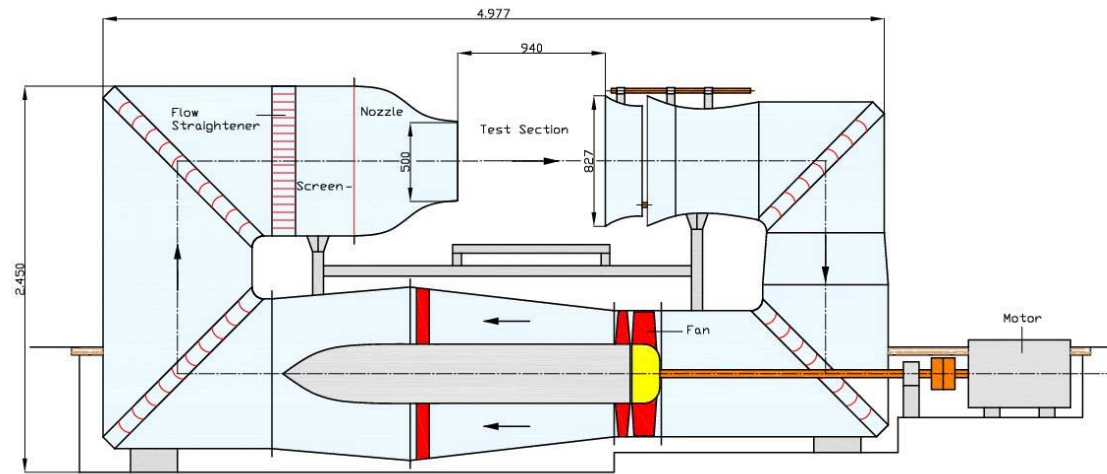
## Planned Improvements

## User Fees

## Contact Information

Dr. Christian Käehler, Department of Mechanical Engineering, Institut für Strömungsmechanik (ISM), Bienroder Weg, 338106 Braunschweig, Germany.  
Tel: (49) 531 391 2971, Fax: (49) 531 391 5952, Email: c.käehler@tu-braunschweig.de, Web site: <http://www.tu-braunschweig.de/ism/institut/wkanlagen/hlb>.

## European and Asian Wind Tunnels



**Small Continuous Atmospheric Wind Tunnel (KWB), Carolo-Wilhelmina Technic University, University at Braunschweig, Institute for Fluid Mechanics, Braunschweig, Germany.**



# European and Asian Wind Tunnels

Subsonic

Germany

Installation Name	Test Section Size	Speed Range
German-Dutch Wind Tunnels (DNW), Braunschweig, Germany	#1: 3.25 x 2.8 m (closed or slotted wall); #2: 3.25 x 2.8 m (open jet)	#1: 90 m/s; #2: 75 m/s
		Temperature Range
	Date Built/Upgrade	
Facility Name	1960/1980 (upgrade)	Reynolds Number (million)
Low Speed Continuous Atmospheric Wind Tunnel (NWB)	Cost	#1: 1.8; #2: 1.5
		Dynamic Pressure
	Operational Status	
	Presumed active as of October 2005	Stagnation Pressure

## Supplementary Technical Parameters

The NWB is an atmospheric, low-speed, closed-circuit tunnel. The settling chamber is equipped with a honeycomb-type flow straightener and three fine mesh screens. 1.4-MV power supply maximum.

## Data Acquisition

Up to 240 measurement channels, PSI system 8400 DTC for pressure. Measurement up to 1024 pressure points.

## Testing Capabilities/Current Programs

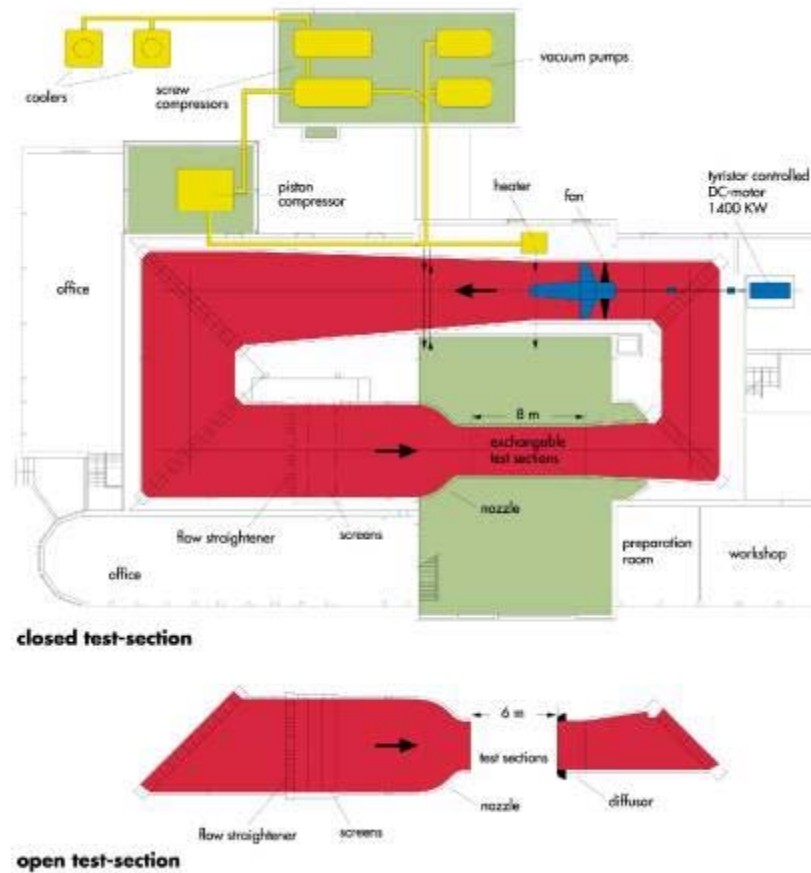
## Planned Improvements

## User Fees

## Contact Information

Dr.-Ing. A. Bergmann, German-Dutch Wind Tunnels (DNW), Lilienthalplatz 7, 38108 Braunschweig, Germany.  
Tel: (49) 531 295 2450, Fax: (49) 531 295 2829, Email: dnw-nwb@dnw.aero, Web site: <http://www.dnw.aero>.

# European and Asian Wind Tunnels



**Low-Speed Continuous Atmospheric Wind Tunnel (NWB), German-Dutch Wind Tunnels (DNW), Braunschweig, Germany.**

# European and Asian Wind Tunnels

Subsonic

Germany

<b>Installation Name</b>	<b>Test Section Size</b>	<b>Speed Range</b>
German-Dutch Wind Tunnels (DNW), Göttingen, Germany	0.6 x 0.6 m	35 m/s (max)
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	Ambient
<b>Facility Name</b>		<b>Reynolds Number (million)</b>
High-Pressure Continuous Subsonic Wind Tunnel (HDG)	<b>Cost</b>	12
		<b>Dynamic Pressure</b>
	<b>Operational Status</b>	
	Presumed active as of September 2005	<b>Stagnation Pressure</b>

## Supplementary Technical Parameters

By pressurizing the air in the wind tunnel up to 100 bar, very high Reynolds numbers are obtained in incompressible flow with velocities up to 35 m/s. Models can be installed in different test sections. Test section exchange is provided by a special locking system without depressurizing the tunnel circuit. For long-term measurements the tunnel shell can be cooled by dripping water. Unique general arrangement.

## Data Acquisition

Unix operating system.

## Testing Capabilities/Current Programs

The HDG is used for investigations that require the simulation of the correct Reynolds number. Systematic steady and unsteady fluid-dynamic research into Reynolds effect on solid generic models such as spheres, cylinders, airfoils, etc. models as well as on high-speed trains, buildings, bridges, and other engineering structures.

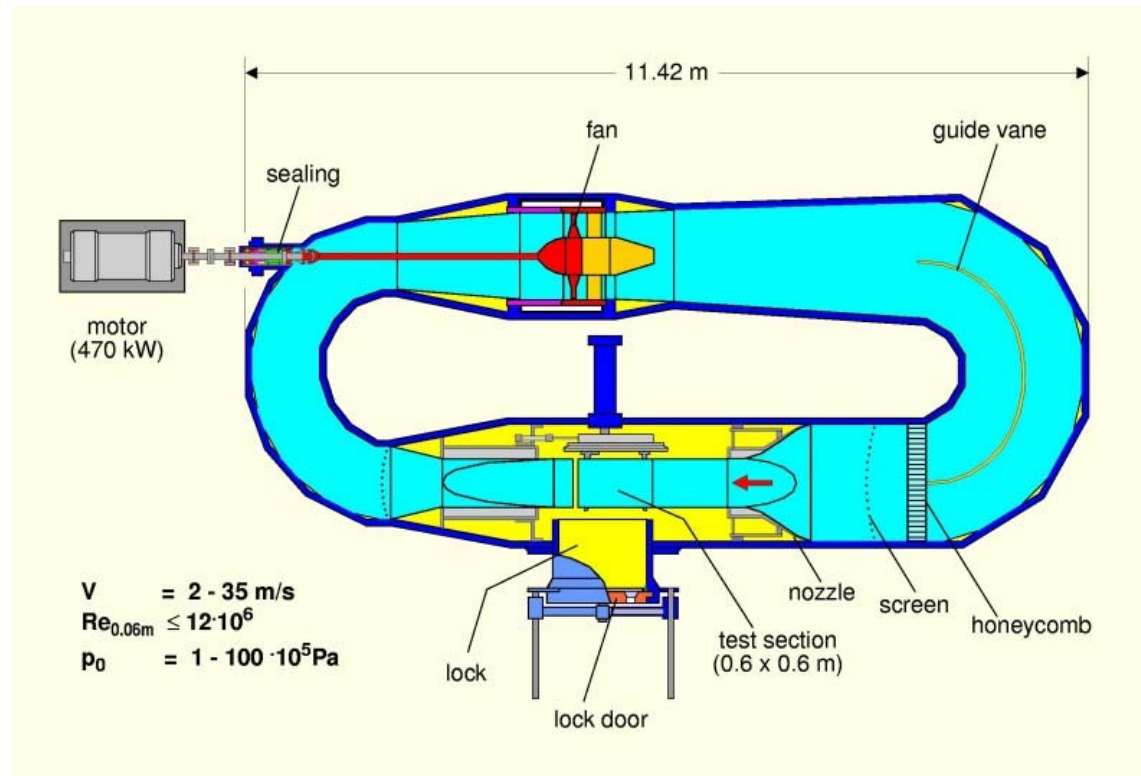
## Planned Improvements

## User Fees

## Contact Information

Dr.-Ing. K.-W. Bock, German-Dutch Wind Tunnels (DNW), Bunsenstrasse 10, 37073 Göttingen, Germany.  
Tel: (49) 551 709 2820, Fax (49) 551 709 2888, Email: dnw-guk@dnw.aero, Web site: <http://www.dnw.aero/>.

## European and Asian Wind Tunnels



**High-Pressure Continuous Subsonic Wind Tunnel (HDG), German-Dutch Wind Tunnels, Göttingen, Germany.**

# European and Asian Wind Tunnels

Subsonic

Germany

<b>Installation Name</b>	<b>Test Section Size</b>	<b>Speed Range</b>
German-Dutch Wind Tunnels (DNW), Köln, Germany	2.4 x 2.4 m	0 to 0.38 Mach
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	116 to 300°K
<b>Facility Name</b>	?/1980-1985	<b>Reynolds Number (million)</b>
Cryogenic Continuous Wind Tunnel (KKK)		9.5
	<b>Cost</b>	<b>Dynamic Pressure</b>
	<b>Operational Status</b>	<b>Stagnation Pressure</b>
	Presumed active as of September 2005	Ambient

## Supplementary Technical Parameters

The originally conventionally low-speed wind tunnel was changed to a high Reynolds-number cryogenic wind tunnel from 1980 to 1985 and entered service in July 1987. A continuously working, low-speed tunnel with a closed tunnel circuit. To achieve higher Reynolds numbers, the gas temperature in the tunnel circuit can be varied between 100 and 300°K by injecting liquid nitrogen. The Reynolds number can then be increased by a factor of 5.5, while the drive power remains constant.

## Data Acquisition

## Testing Capabilities/Current Programs

Due to the variation of the gas temperature, the influence of Mach number and Reynolds number on the aerodynamic coefficients of model measurements can be investigated separately.

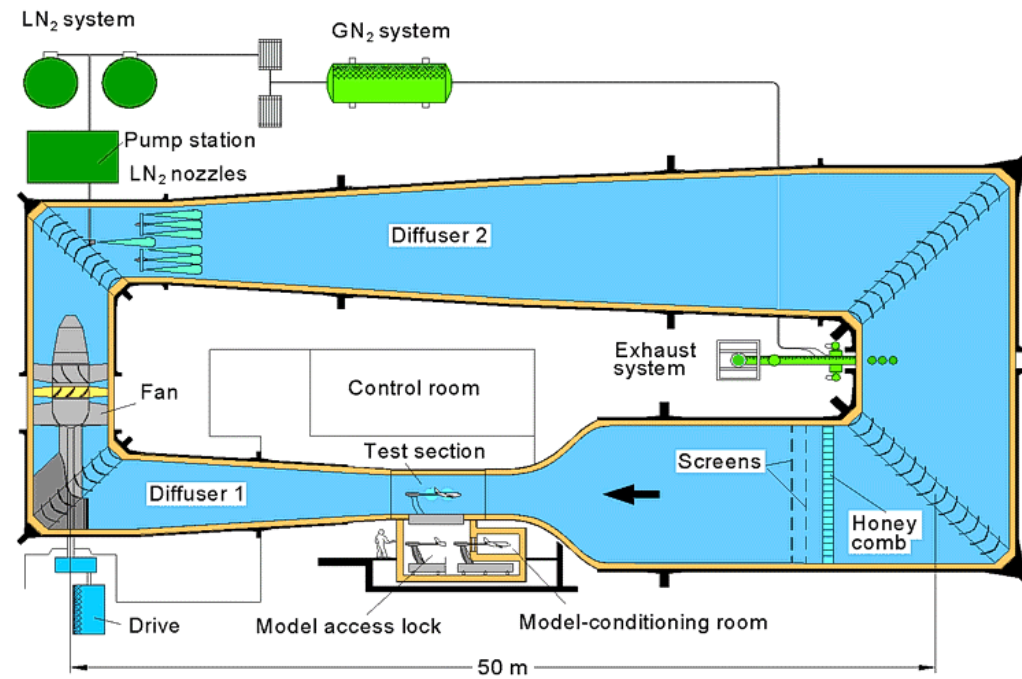
## Planned Improvements

## User Fees

## Contact Information

R. Rebstock, German-Dutch Wind Tunnels (DNW), KKK, Linder Höhe, 51147 Köln, Germany.  
Tel: (49) 2203 601 3700, Fax: (49) 2203 695961, E-Mail: dnw-kkk@dnw.aero, Web site: <http://www.dnw.aero/>.

## European and Asian Wind Tunnels



**Continuous Cryogenic Wind Tunnel (KKK), German-Dutch Wind Tunnels (DNW), Köln, Germany.**

# European and Asian Wind Tunnels

Subsonic

Germany

Installation Name	Test Section Size	Speed Range
Institute for Aerodynamics and Gas Dynamics (IAG), University of Stuttgart, Stuttgart, Germany	0.73 x 2.73 x 3.15 m	90 m/s
		Temperature Range
	Date Built/Upgrade	
Facility Name	1962	Reynolds Number (million)
Laminar Wind Tunnel (LWK)		5 (max)
	Cost	Dynamic Pressure
	Operational Status	Stagnation Pressure
	Presumed active as of October 2005	

## Supplementary Technical Parameters

Closed aerodynamic circuit. Long blow down. Closed measuring section and open air feedback (Eiffel-type), motor speed of 220 kW. A high contraction ratio of 100:1 as well as integrated filter mats  $u < 0.2\%$ .

## Data Acquisition

Scanivalves, PSI Vielfachdruckmesssystem, MKS Baratron, boundary layer probe, infrared camera. Dynamometer infrared camera TH7102. Visualization flows can be done by coating methods, tufts or smoke probes, and laser light art.

## Testing Capabilities/Current Programs

Measurement of two-dimensional models.

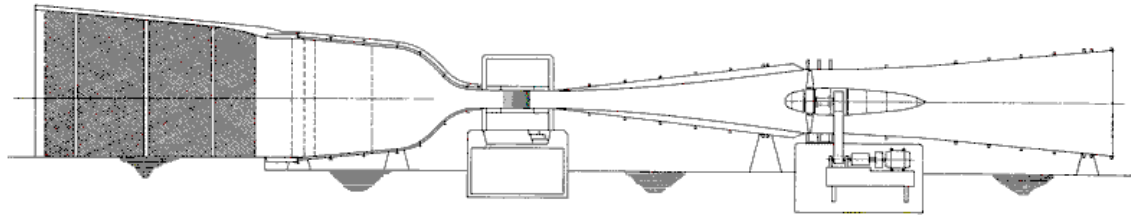
## Planned Improvements

## User Fees

## Contact Information

Dr. W. Pepper, University of Stuttgart, Pfaffenwaldring 21, D-70569 Stuttgart, Germany.  
Tel/Fax: (49) 0711 685 3470, Email: wuerz@iag.uni-stuttgart.de, Web site: <http://www.iag.uni-stuttgart.de/laminarwindkanal/&prev=/sear>.

## European and Asian Wind Tunnels



**Laminar Wind Tunnel (LWK), Institute for Aerodynamics & Gas Dynamics (IAG), University of Stuttgart, Stuttgart, Germany.**



# European and Asian Wind Tunnels

Subsonic

Germany

Installation Name	Test Section Size	Speed Range
Institute for Aerodynamics and Gas Dynamics (IAG), University of Stuttgart, Stuttgart, Germany	0.373 x 0.6 x 0.8 m	30 m/s
		Temperature Range
	Date Built/Upgrade	
Facility Name		Reynolds Number (million)
Model Wind Tunnel		0.03 to 0.4
	Cost	Dynamic Pressure
	Operational Status	Stagnation Pressure
	Presumed active as of October 2005	

## Supplementary Technical Parameters

The model wind tunnel has a long-blowdown, closed measuring section, open air feedback (Eiffel type). It has a 6-blade blower with 4-kW three-phase motor. Maximum stagnation pressure amounts to 75mmWC. Turbulence/flow rate of  $2 \times 10^{-4}$  to  $7.5 \times 10^{-4}$ .

## Data Acquisition

PC supported system with 12-bit AD Wandler.

## Testing Capabilities/Current Programs

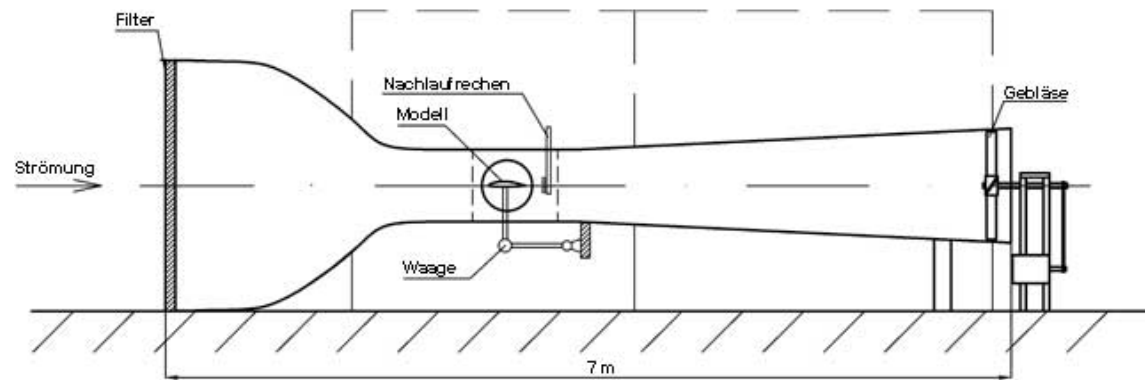
## Planned Improvements

## User Fees

## Contact Information

Dr. W. Pepper, Institute for Aerodynamics and Gas Dynamics (IAG), University of Stuttgart, Pfaffenwaldring 21, D-70569 Stuttgart, Germany.  
Tel/Fax: (49) 711 685 3470, Email: wuerz@iag.uni-stuttgart.de, Web site: <http://www.iag.uni-stuttgart.de/>.

## European and Asian Wind Tunnels



**Model Wind Tunnel, Institute for Aerodynamics and Gas Dynamics (IAG), University of Stuttgart, Stuttgart, Germany.**

# European and Asian Wind Tunnels

Subsonic

Germany

<b>Installation Name</b>	<b>Test Section Size</b>	<b>Speed Range</b>
Technical University of Darmstadt, Darmstadt, Germany	2.2 x 2.9 x 4.3 m	68 m/s
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	Ambient
<b>Facility Name</b>	1937	<b>Reynolds Number (million)</b>
2.2 x 2.9 m Subsonic Wind Tunnel	<b>Cost</b>	1.14
		<b>Dynamic Pressure</b>
	<b>Operational Status</b>	
	Presumed active as of October 2005	<b>Stagnation Pressure</b>
		Ambient

## Supplementary Technical Parameters

Closed, single return wind tunnel. 300-kW power, single stage axial fan, Amb/Amb stagnation pressure, PSI system, no ground effects, 50 bar air supply system, 500 kg air mass flow.

## Data Acquisition

Micro Vax

## Testing Capabilities/Current Programs

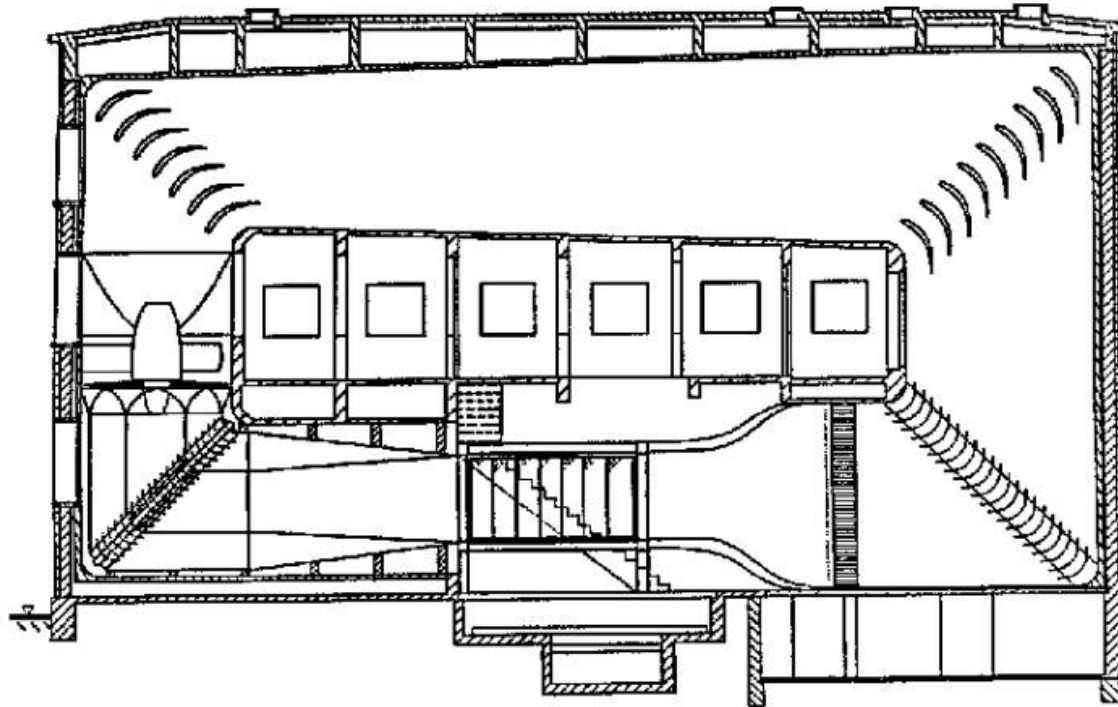
## Planned Improvements

## User Fees

## Contact Information

Dr. Cameron Tropea, Strömungslehre und Aerodynamik, Fachbereich 16, Building/Room L101/473, Petersenstrasse 30, D-64287 Darmstadt, Germany.  
Tel: (49) 6151 162854, Fax: (49) 6151 16 4754, Email: ctropea@sla.tu-darmstadt.de, Web site: <http://tu-darmstadt.de>.

## European and Asian Wind Tunnels



2.2 x 2.9m Unterschallwindkanal

**2.2 x 2.9 m Subsonic Wind Tunnel, Technical University of Darmstadt, Darmstadt, Germany.**

# European and Asian Wind Tunnels

Subsonic

Indonesia

Installation Name	Test Section Size	Speed Range
Aero-Gas Dynamics and Vibration Laboratory (LAGG), Agency for Assessment and Application of Technology (BPPT), National Center for Research, Science and Technology (PUSPIPTEK), Serpong, Indonesia	4 x 3 x 10 m	110 m/s
		Temperature Range
	Date Built/Upgrade	
Facility Name	1987-1988	Reynolds Number (million)
Indonesia Low Speed Wind Tunnel (ILST)	Cost	6.5
	US\$18 million (estimated construction cost)	Dynamic Pressure
	Operational Status	
	Confirmed active as of 2004	Stagnation Pressure

## Supplementary Technical Parameters

Developed under bilateral technological cooperation between the governments of Republic Indonesia (BPPT) and the Netherlands National Aerospace Laboratory (NLR). Aeronautical and industrial aerodynamics circuit of a closed return type with atmospheric and closed walled test sections. Contraction ratio of 1:9. Equipped with a ground plane to enable aircraft landing and take off simulation, and with 200 m<sup>3</sup> pressurized dry air of 60 bars to allow testing on air turbine powered engine

## Data Acquisition

256 channels

## Testing Capabilities/Current Programs

CN235 aircraft development testing (civil and military), N250 aircraft power test using rotating shaft balance, slipstream model research tests, industrial model testing (ships, wing-in-ground effect craft, long-span bridges), N250 flutter test using aeroelastic model, N2130 aircraft testing, UAV testing, aircraft landing and take off testing, air turbine powered engine simulators.

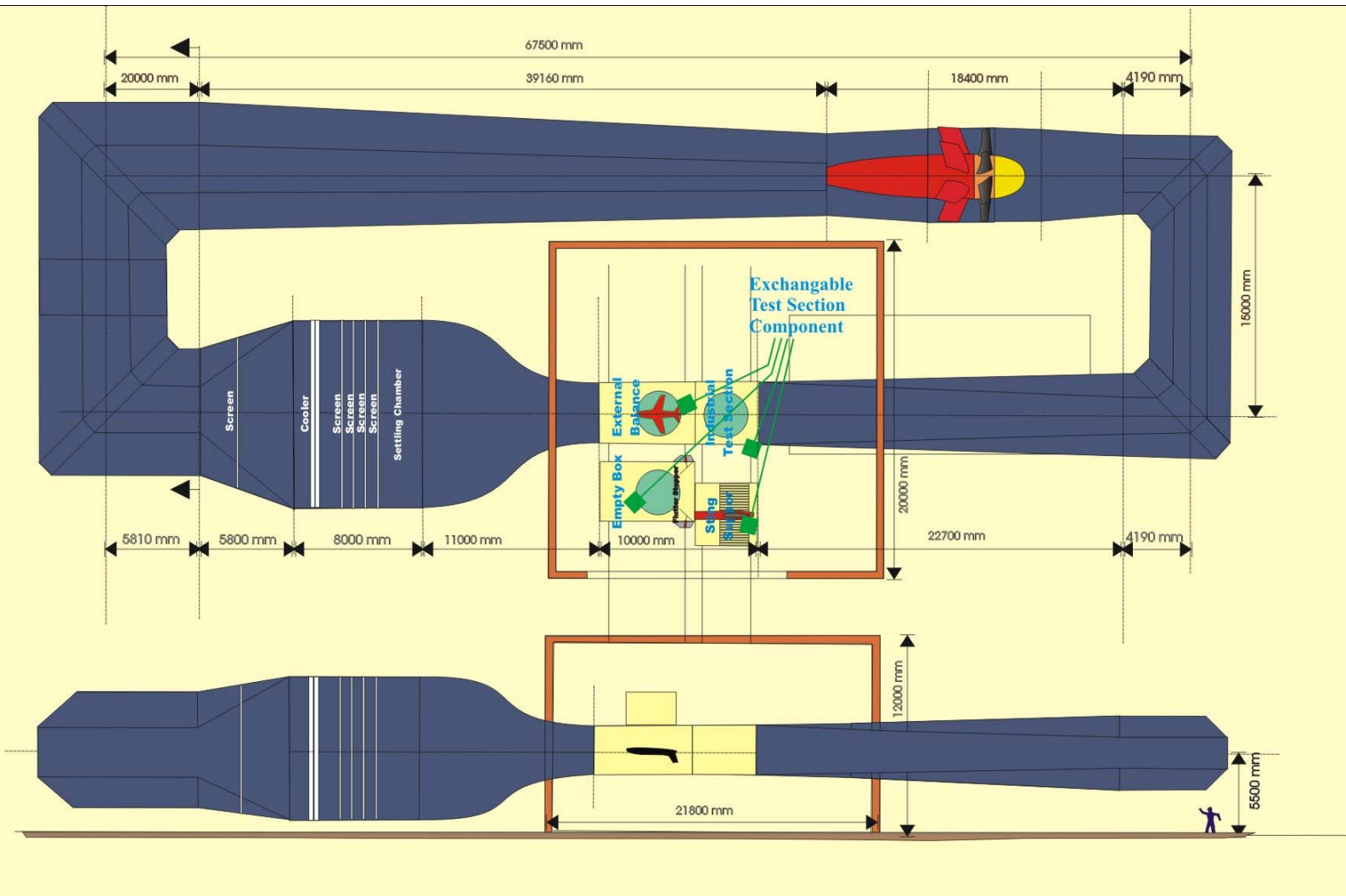
## Planned Improvements

## User Fees

## Contact Information

Dr. Surjatin Wiriadidjaja, UPT-LAGG, BPP Teknologi, Puspiptek, Serpong, Tangerang 15310, Indonesia.  
Tel: (62) 21 756 0205, Fax: (62) 21 756 0901, Email: [lagg@idola.net.id](mailto:lagg@idola.net.id), Web site: <http://lagg.or.id/ilst.htm>.

## European and Asian Wind Tunnels



Indonesia Low-Speed Wind Tunnel (ILST), National Center for Research, Science and Technology (PUSPIPTK), Serpong, Indonesia

# European and Asian Wind Tunnels

Subsonic

Italy

Installation Name	Test Section Size	Speed Range
Galleria del Vento, Milan Polytechnic University (GVPM), Milan, Italy	#1: 4 x 3.84 m (aeronautics test section); #2: 3.84 x 13.84 x 36 m (civil test section)	#1: 55 m/s; #2: 14 m/s
		Temperature Range
	Date Built/Upgrade	
Facility Name	2001	Reynolds Number (million)
GVPM Subsonic Wind Tunnel		0.1 to 1.1
	Cost	Dynamic Pressure
	Operational Status	Stagnation Pressure
	Presumed active as of October 2005	Ambient

## Supplementary Technical Parameters

This facility is fitted with a 12-blade fan, 14 motors, arranged in two rows of seven, separated by 2 x 2 m ducts. Overall power of 1.4 MW and a maximum speed of 55 m/s (200 km/h). Closed circuit, single vertical return.

## Data Acquisition

National instruments cards.

## Testing Capabilities/Current Programs

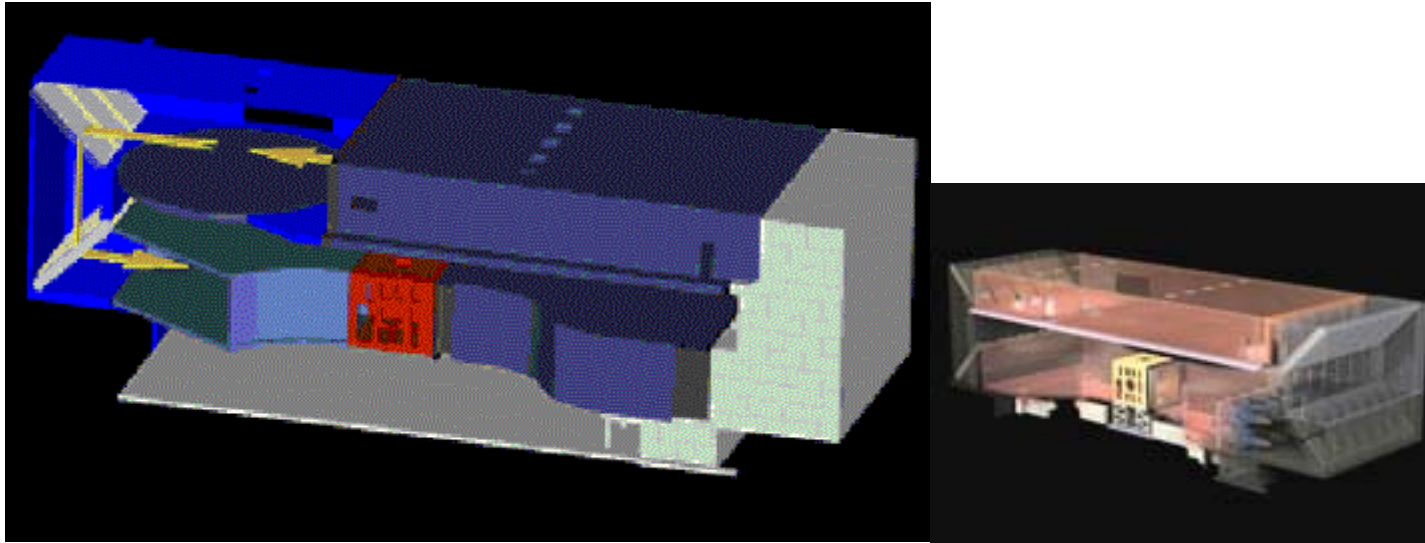
## Planned Improvements

## User Fees

## Contact Information

Professor Giuseppe Gibertini, Department of Aerospace Engineering, GVPM, Campus Bovisa Sud, Via La Masa 34, 20156 Milan, Italy.  
Tel: (39) 02 2399 8389, Fax: (39) 02 2399 8334, Email: [giuseppe.gibertini@polimi.it](mailto:giuseppe.gibertini@polimi.it), Web site: <http://www.windtunnel.polimi.it/english/impianto/impianto.htm>.

## European and Asian Wind Tunnels



**GVPM Subsonic Wind Tunnel, Milan Polytechnic University, Milan, Italy.**



# European and Asian Wind Tunnels

Subsonic

Italy

Installation Name	Test Section Size	Speed Range
Italian Aerospace Research Center (CIRA), Capua, Italy		0.25 to 0.7 Mach
		Temperature Range
	Date Built/Upgrade	-40°C to -35°C
Facility Name		Reynolds Number (million)
Icing Wind Tunnel (IWT)	Cost	
		Dynamic Pressure
	Operational Status	
	Presumed active as of October 2005	Stagnation Pressure
		up to 1.45 bar

## Supplementary Technical Parameters

Closed circuit wind tunnel. The IWT is equipped with three different test sections and an open jet configuration for a total of four different configurations.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Italian Aerospace Research Center (Centro Italiano Ricerche Aerospaziali: CIRA), Via Maiorise, 81043 Capua, Italy.  
Tel: (39) 0823 623001, Email: [info@cira.it](mailto:info@cira.it), Web site: <http://www.cira.it/>.

## European and Asian Wind Tunnels



**Icing Wind Tunnel (IWT), Italian Aerospace Research Center (CIRA), Capua, Italy.**

# European and Asian Wind Tunnels

Subsonic

Japan

Installation Name	Test Section Size	Speed Range
Japan Aerospace Exploration Agency (JAXA), Institute of Aerospace Technology (IAT), Aerospace Research Center (ARC), Wind Tunnel Technology Center (WINTEC), Tokyo, Japan	2 x 2 x 4 m	3 to 60 m/s (continuous use), 67 m/s (max)
		Temperature Range
	Date Built/Upgrade	
Facility Name	1971/1994 (upgrade)	Reynolds Number (million)
2 x 2 m Low Speed Wind Tunnel	Cost	
		Dynamic Pressure
	Operational Status	
	Presumed active as of December 2005	Stagnation Pressure

## Supplementary Technical Parameters

Continuous circulation type. Air blower: 250 kW. Gust wind tunnel: uniform air flow 3 – 30 m/sec. Gust generator: movable cascade pitch angle  $0 \sim \pm 0.15$  radians; oscillations 0 – 20 Hz; gusts  $0 \sim \pm 4.5$  m/sec for 0.05 seconds; waveforms: sine wave, triangular wave, square wave, and random wave. Robot model mount: 6 degrees of freedom; load capacity 1470 newtons; position accuracy  $\pm 0.5$  mm.

## Data Acquisition

## Testing Capabilities/Current Programs

Studies of wind loads on aircraft and spacecraft.

## Planned Improvements

## User Fees

## Contact Information

Dr. Masashi Shigemi (Director), WINTEC, Japan Aerospace Exploration Agency, Institute of Aerospace Technology, Aerospace Research Center, 7-44-1 Jindaiji Higashi-machi, Chofu-shi, Tokyo 182-8522, Japan.  
Tel: (81) 3 422 40 3000, Fax: (81) 3 422 40 3281, Email: wintec@chofu.jaxa.jp, Email (Director): shigemi.masashi@jaxa.jp, Web site: <http://www.iat.jaxa.jp/res/wttc/b02.html>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Subsonic

Japan

Installation Name	Test Section Size	Speed Range
Japan Aerospace Exploration Agency (JAXA), Institute of Aerospace Technology (IAT), Aerospace Research Center (ARC), Wind Tunnel Technology Center (WINTEC), Tokyo, Japan	6.5 x 5.5 m	1 to 70 m/s
		Temperature Range
	Date Built/Upgrade	
Facility Name	1965	Reynolds Number (million)
6.5 x 5.5 m Low Speed Wind Tunnel	Cost	
		Dynamic Pressure
	Operational Status	
	Presumed active as of December 2005	Stagnation Pressure

## Supplementary Technical Parameters

Continuous circulation type. Test section octagonal shaped with four 1-meter corners. Air blower: 3,000 kW, fan blade variable-angle type and rotation speed control type at the same time. Test section: strut-mounted pyramid six-component balance, sting-mounted internal balance, operating at 4 free angles. Ground effect test device: moving belt type, 50 m/sec.

## Data Acquisition

## Testing Capabilities/Current Programs

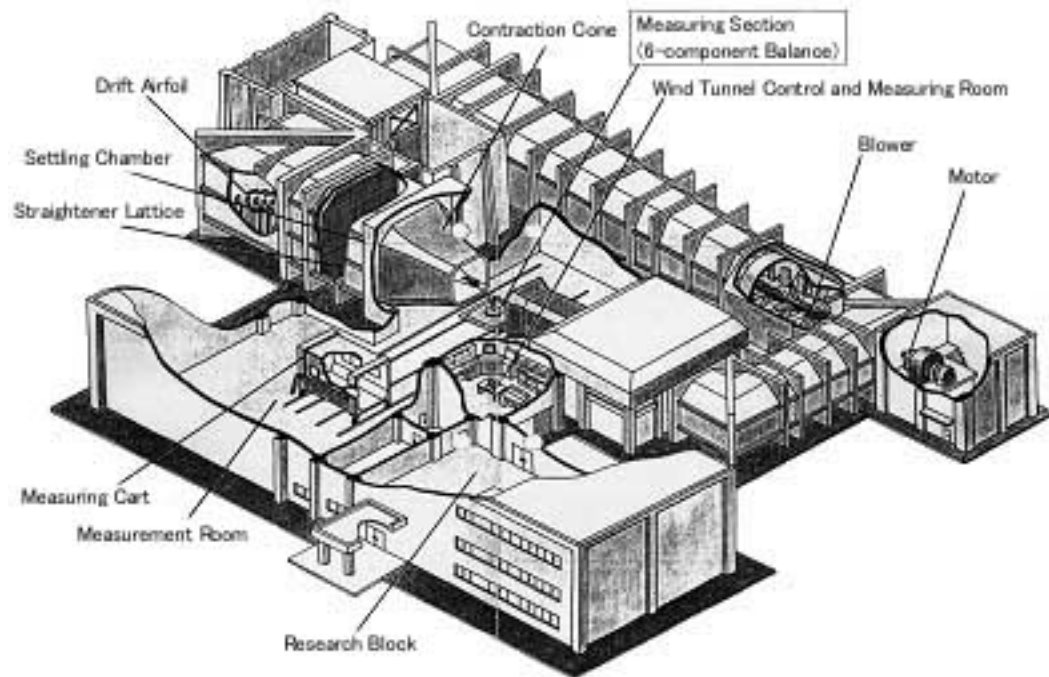
## Planned Improvements

## User Fees

## Contact Information

Dr. Masashi Shigemi (Director), WINTEC, Japan Aerospace Exploration Agency, Institute of Aerospace Technology, Aerospace Research Center, 7-44-1 Jindaiji Higashi-machi, Chofu-shi, Tokyo 182-8522, Japan.  
Tel: (81) 3 422 40 3000, Fax: (81) 3 422 40 3281, Email (WINTEC): wintec@chofu.jaxa.jp, Email (Director): shigemi.masashi@jaxa.jp, Web site: <http://www.iat.jaxa.jp/res/wttc/b02.html>.

## European and Asian Wind Tunnels



**6.5 x 5.5 m Low-Speed Wind Tunnel, Japan Aerospace Exploration Agency, Institute of Aerospace Technology, Aerospace Research Center, Wind Tunnel Technology Center (WINTeC), Tokyo, Japan.**

# European and Asian Wind Tunnels

Subsonic

Japan

Installation Name	Test Section Size	Speed Range
Kawada Wind Tunnel Research Center, Kawada Industries Inc., Tochigi, Japan	#1: 2.0 x 2.5 x 15.0 m; #2: 2.5 x 2.5 x 5.0 m	#1: 50 m/s; #2: 45 m/s
		Temperature Range
	Date Built/Upgrade	Ambient
Facility Name	1992	Reynolds Number (million)
Kawada Wind Tunnel		#1: 3.4; #2: 3.1
	Cost	Dynamic Pressure
	Operational Status	Stagnation Pressure
	Presumed active as of December 2005	#1: 156.25 kg/m <sup>2</sup> ; #2: 126.56 kg/m <sup>2</sup>

## Supplementary Technical Parameters

Single return, open circuit. Powered by a 220-kW fan. Two external (one three-component and one six-component) balances. No air supply system, no air mass flow, and no ground effects.

## Data Acquisition

HP 3852A, spring balance vibration data

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

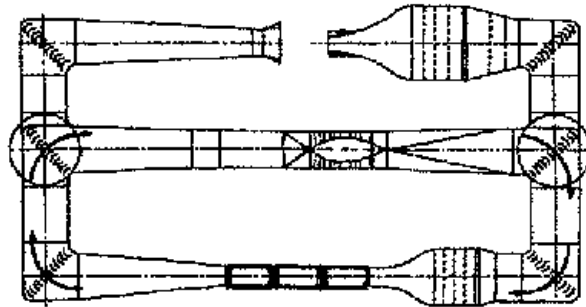
## Contact Information

Katsuya Edamoto, Aircraft and Mechanical Systems Division, 122-1 Hagadai, Hagamachi, Tochigi, 321-3325, Japan.  
Tel: (81) 28 677 1177, Tel (Edamoto): (81) 28 677 5707, Fax: (81) 28 677 4520, Email: mech@kawada.co.jp, Web site: <http://www.kawada.co.jp/aircraft/>.

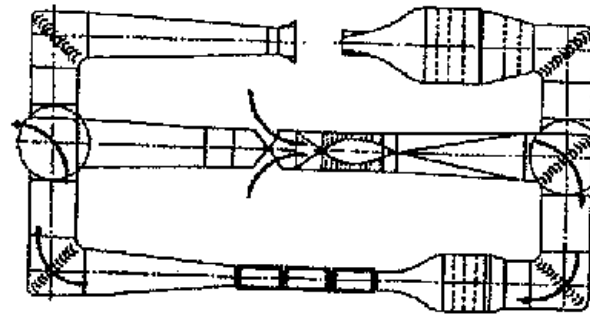
## European and Asian Wind Tunnels

THE CLOSED TEST SECTION IS USED AS A TWO DIM. TUNNEL. IT IS EQUIPPED WITH A THREE COMPONENT FORCE BALANCE AND A SPRING SUSPENSION BALANCE.

THE OPEN TEST SECTION IS A THREE DIM. TUNNEL, AND IS EQUIPPED WITH A SIX COMPONENT FORCE BALANCE.



CLOSED CIRCUIT



OPEN CIRCUIT

**KAWADA Wind Tunnel, Kawada Wind Tunnel Research Center Kawada Industries, Tochigi, Japan.**



# European and Asian Wind Tunnels

Subsonic

Korea (South)

Installation Name	Test Section Size	Speed Range
Agency for Defense and Development (ADD), Wind Tunnel Testing Laboratory, Taejo, Daejeon, Republic of Korea	3 x 2.25 x 8.75 m	10 to 120 m/s
		Temperature Range
	Date Built/Upgrade	
Facility Name	1998	Reynolds Number (million)
Low Speed Wind Tunnel		8
	Cost	Dynamic Pressure
	US\$12 million (estimated)	
	Operational Status	Stagnation Pressure
	Presumed active as of November 2005	Atmospheric

## Supplementary Technical Parameters

This wind tunnel features three interchangeable test sections, solid wall, open-jet, slotted wall, probe traverse system, external balance, upper turntable, and model handling sytem. It is closed-circuit, continuous-flow, atmospheric. Powered by a 2400-kW, 11-blade fan.

## Data Acquisition

NEFF 471 128 channel

## Testing Capabilities/Current Programs

Aerodynamic testing of aircraft, missiles, projectiles, and underwater vehicles. Testing capabilities: basic force and measurement, dynamic stability, aeroelasticity, rotary balance, ground effect, power-on simulation, control surface hinge moment, air intake performance, flow visualization, 2-D airfoil, rotary wing, aero acoustics.

## Planned Improvements

## User Fees

## Contact Information

Wind Tunnel Testing Laboratory, Agency for Defense and Development (ADD), PO Box 35, Yuseong, Daejeon, ROK.  
Tel: (82) 42 821 2011, Web site: <http://www.add.re.kr/eng/wind.asp>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Subsonic

Korea (South)

Installation Name	Test Section Size	Speed Range
Chosun University, Department of Aerospace Engineering, Gwangju, Republic of Korea	1x 1 x 3 m (solid wall, square)	60 m/s (max)
		Temperature Range
	Date Built/Upgrade	
Facility Name	1999	Reynolds Number (million)
Closed-Circuit Subsonic Wind Tunnel		
	Cost	Dynamic Pressure
	US\$253,900 (construction cost in 1999 KRW, Jan 2006 conversion rate: 1USD=981.392 KRW)	
	Operational Status	Stagnation Pressure
	Assumed active per personal correspondence 1/15/06.	

## Supplementary Technical Parameters

Contraction Ratio: 6. Fan: 1.5 m diameter, 132 kW.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Dr. Jaesoo Kim (Manager), Department of Aerospace Engineering, Chosun University, 375 Susuk-Dong, Gwangju, 501-759, ROK.  
Tel: (82) 62 230 7080, E-mail: jsckim@mail.chosun.ac.kr, Web site: [http://www.chosun.ac.kr/eng/sub\\_03/sub3\\_06.html](http://www.chosun.ac.kr/eng/sub_03/sub3_06.html).

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Subsonic

Korea (South)

<b>Installation Name</b>	<b>Test Section Size</b>	<b>Speed Range</b>
Chunbuk National University, Department of Aerospace Engineering, Jeonju, Republic of Korea	0.6 x 0.45 x 1 m (open, rectangular)	35 m/s (max)
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	
<b>Facility Name</b>	1988	<b>Reynolds Number (million)</b>
0.6 m Wind Tunnel	<b>Cost</b>	
		<b>Dynamic Pressure</b>
	<b>Operational Status</b>	<b>Stagnation Pressure</b>
	Assumed active per personal correspondence 1/15/06.	

## Supplementary Technical Parameters

Closed circuit. Contraction Ratio: 6.25, Fan: 0.9 m diameter, 22 kW.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Dr. Bongzoo Sung (Manager), Department of Aerospace Engineering, Chunbuk National University, Duckjin-Gu, Jeonju, 561-756, ROK.  
 Tel: (82) 63 270 3994/2468, Fax: (82) 63 270 2472, Email (Manager): bzsung@chonbuk.ac.kr, Email (Dept): aerospace@chonbuk.ac.kr, Web site:  
[http://aerospace.chonbuk.ac.kr/eng\\_1.htm](http://aerospace.chonbuk.ac.kr/eng_1.htm).

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Subsonic

Korea (South)

Installation Name	Test Section Size	Speed Range
Chunbuk National University, Jeonju, Republic of Korea	0.6 x 0.6 x 1.3 m (solid wall, square)	60 m/s (max)
		Temperature Range
	Date Built/Upgrade	
Facility Name	1991	Reynolds Number (million)
Closed-Circuit Subsonic Wind Tunnel		
	Cost	Dynamic Pressure
	US\$88,648 (construction cost in 1991 KRW, Jan 2006 conversion rate: 1USD=981.392 KRW)	
	Operational Status	Stagnation Pressure
	Assumed active per personal correspondence 1/15/06.	

## Supplementary Technical Parameters

Closed circuit. Contraction ratio: 7.1. Fan: 1.5 m diameter, 30 kW.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Dr. Byungjoon Rho (Manager), Chunbuk National University, 664-14 1-Ga Duckjin-Dong Duckjin-Gu Jeonju, Jeonbuk, 561-156, ROK.  
Tel: (82) 63 270 2468, Fax: (82) 63 270 2472, E-mail: rhobj@chonbuk.ac.kr, Web site: <http://www.cbnu.edu/>, <http://fluid.chonbuk.ac.kr>,  
<http://aerospace.chonbuk.ac.kr>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**



# European and Asian Wind Tunnels

Subsonic

Korea (South)

Installation Name	Test Section Size	Speed Range
Chungnam National University, Department of Aerospace Engineering, Daejeon, Republic of Korea	1.25 x 1.25 x 4 m (solid wall/open, square)	70 m/s (max)
		Temperature Range
	Date Built/Upgrade	
Facility Name	2000	Reynolds Number (million)
Aero-Acoustic Wind Tunnel		
	Cost	Dynamic Pressure
	US\$305,811 (construction cost in 2000 KRW, Jan 2006 conversion rate: 1USD=980.999KRW)	
	Operational Status	Stagnation Pressure
	Assumed active per personal correspondence 1/15/06.	

## Supplementary Technical Parameters

Contraction Ratio: 5.76. Fan: 2.35 m diameter, 260 kW.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Dr. Jongsoo Choi (Manager), Department of Aerospace Engineering, Chungnam National University, 220 Gung-Dong, Yuseong-Gu, Daejeon 305-764, ROK.  
Tel: (82) 42 821 6683, E-mail: jchoi@cnu.ac.kr, Web site: [http://plus.cnu.ac.kr/eng/sub03\\_menu.jsp?code=0509](http://plus.cnu.ac.kr/eng/sub03_menu.jsp?code=0509).

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Subsonic

Korea (South)

<b>Installation Name</b>	<b>Test Section Size</b>	<b>Speed Range</b>
Hanyang University, Department of Mechanical Engineering, Seoul, Republic of Korea	0.8 x 0.8 x 1.6 m (solid wall, square)	65 m/s (max)
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	
<b>Facility Name</b>	2001	<b>Reynolds Number (million)</b>
Small Subsonic Wind Tunnel	<b>Cost</b>	
	US\$91,723 (construction cost in 2001 KRW, Jan 2006 conversion rate: 1USD=981.213 KRW)	<b>Dynamic Pressure</b>
	<b>Operational Status</b>	
	Assumed active per personal correspondence 1/15/06.	<b>Stagnation Pressure</b>

## Supplementary Technical Parameters

Circuit: suction, Contraction ratio: 6.25, Fan: 1.8 m diameter, 55 kW.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Dr. Jinsoo Cho (Manager), Department of Mechanical Engineering, Hanyang University, 17 Haengdang-Dong, Sungdong-Gu, Seoul 133-791, ROK.  
Tel: (82) 2 2290 0429, Fax: (82) 2 2281 4016, E-mail: jscho@hanyang.ac.kr, Web site: <http://me.hanyang.ac.kr/eng>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Subsonic

Korea (South)

Installation Name	Test Section Size	Speed Range
Inha University, Department of Aerospace Engineering, Incheon, Republic of Korea	1 x 1 x 2 m (solid wall, octagonal)	70 m/s (max)
		Temperature Range
	Date Built/Upgrade	
Facility Name	1978	Reynolds Number (million)
Aerospace Engineering Wind Tunnel		
	Cost	Dynamic Pressure
	US\$36,479 (construction cost in 1978 KRW, Jan 2006 conversion rate: 1USD = 981.392 KRW)	
	Operational Status	Stagnation Pressure
	Assumed active per personal correspondence 1/15/06.	

## Supplementary Technical Parameters

Contraction Ratio: 4. Fan: 1.6 m diameter, 75 kW.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Dr. Beomsoo Kim (Manager), Department of Aerospace Engineering, Inha University, 253 Young-Hyung-Dong, Nam-Goo, Incheon, ROK.  
Tel: (82) 32 860 7355, E-mail: bskim@inha.ac.kr, Web site: <http://aerospace.inha.ac.kr/>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Subsonic

Korea (South)

Installation Name	Test Section Size	Speed Range
Konkuk University, Department of Aerospace, Seoul, Korea	1 x 1 x 3.5 m (solid wall, square)	45.1 m (max)
		Temperature Range
	Date Built/Upgrade	
Facility Name	2000	Reynolds Number (million)
Multi-Purpose Wind Tunnel		
	Cost	Dynamic Pressure
	US\$3,368 (construction cost in 2000 KRW, Jan 2006 conversion rate 1USD = 979.928 KRW)	
	Operational Status	Stagnation Pressure
	Assumed active per personal correspondence 1/15/06.	

## Supplementary Technical Parameters

Contraction Ratio: 7.2. Fan: 2.25 m diameter, 90 kW.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Dr. Younghawn Byun (Manager), Konkuk University, Department of Aerospace, 1 Hwayang-dong, Gwangjin-Gu, Seoul, ROK.  
Tel.: 82-2-450-3114 ,Web site: <http://www.konkuk.ac.kr:8001/eng/>, <http://aerospace.konkuk.ac.kr/>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**



# European and Asian Wind Tunnels

Subsonic

Korea (South)

Installation Name	Test Section Size	Speed Range
Korea Advanced Institute of Science and Technology, Aeronautics Department, Daejeon, Republic of Korea	1.016 x 0.712 x 1.52 m (solid wall, rectangular)	62 m/s (max)
		Temperature Range
	Date Built/Upgrade	
Facility Name	1981	Reynolds Number (million)
Low Turbulence Open Circuit Wind Tunnel		
	Cost	Dynamic Pressure
	US\$71,460 (construction cost in 1981 KRW, Jan 2006 conversion rate: 1USD = 979.571 KRW)	
	Operational Status	Stagnation Pressure
	Assumed active per personal correspondence 1/15/06.	

## Supplementary Technical Parameters

Circuit: suction. Contraction ratio: 7.2. Fan: 1.575 m diameter, 112 kW.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

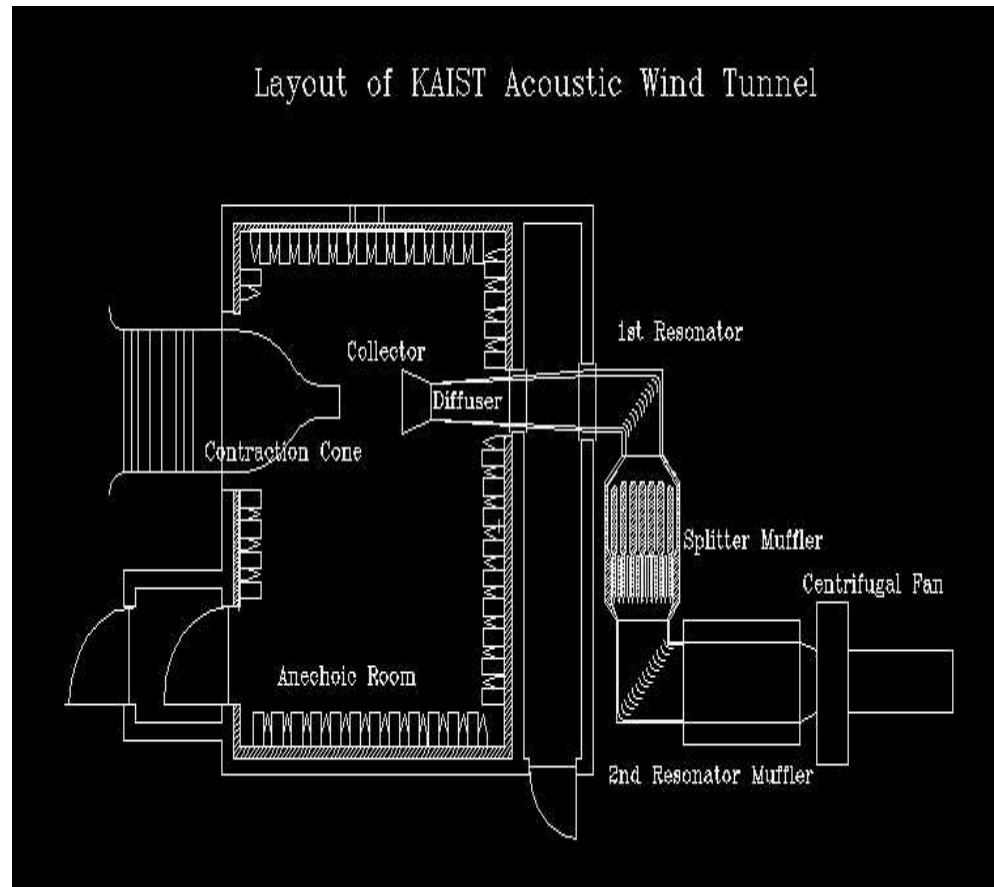
## User Fees

## Contact Information

Dr. Seung O Park (Manager), Korea Advanced Institute of Science and Technology, 373-1 Aeronautics Department, #2311 Gueong-Dong, Yuseong-Gu, Daejeon, 305-701, ROK.

Tel: (82) 42 869 3753, 3785, E-mail: [sopark@sop1.kaist.ac.kr](mailto:sopark@sop1.kaist.ac.kr), Web site: <http://sop25.kaist.ac.kr/index.html>.

## European and Asian Wind Tunnels



**KAIST Anechoic Wind Tunnel, Korea Advanced Institute of Science and Technology, Daejeon, South Korea (ROK).**

# European and Asian Wind Tunnels

Subsonic

Korea (South)

Installation Name	Test Section Size	Speed Range
Korea Aerospace Research Institute (KARI), Daejeon, Republic of Korea	#1: 4 x 3 x 10 m (closed); #2: 6 x 4.5 x 13.5 m (slotted); #3: 4 x 3 x 8 m (open jet)	#1: 0.32 Mach; #2: 0.15 Mach; #3: 0.27 Mach
		Temperature Range
	Date Built/Upgrade	
Facility Name	1999	Reynolds Number (million)
4 m Low Speed Wind Tunnel		#1: 7.4; #2: 3.5; #3: 6.2
	Cost	Dynamic Pressure
	US\$20 million (estimated)	
	Operational Status	Stagnation Pressure
	Presumed active as of January 2006	Atmospheric

## Supplementary Technical Parameters

Closed-circuit, continuous-flow, atmospheric. The 4-meter, low-speed tunnel is powered by 3740-kW fan, has external balances, zero ground effects, air supply of 7.8 bar, air mass flow of 270 l/s.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Dr. Eusup Sim (Director), Space Test Division, Korea Aerospace Research Institute, 45 Eoeun-dong, Yousung-gu 2234 Daejeon, 305-333 ROK.  
Tel: (82) 42 860 2470, Fax: (82) 42 860 2234, Email: esim@kari.re.kr, Web site: <http://www.kari.re.kr/>.

# European and Asian Wind Tunnels

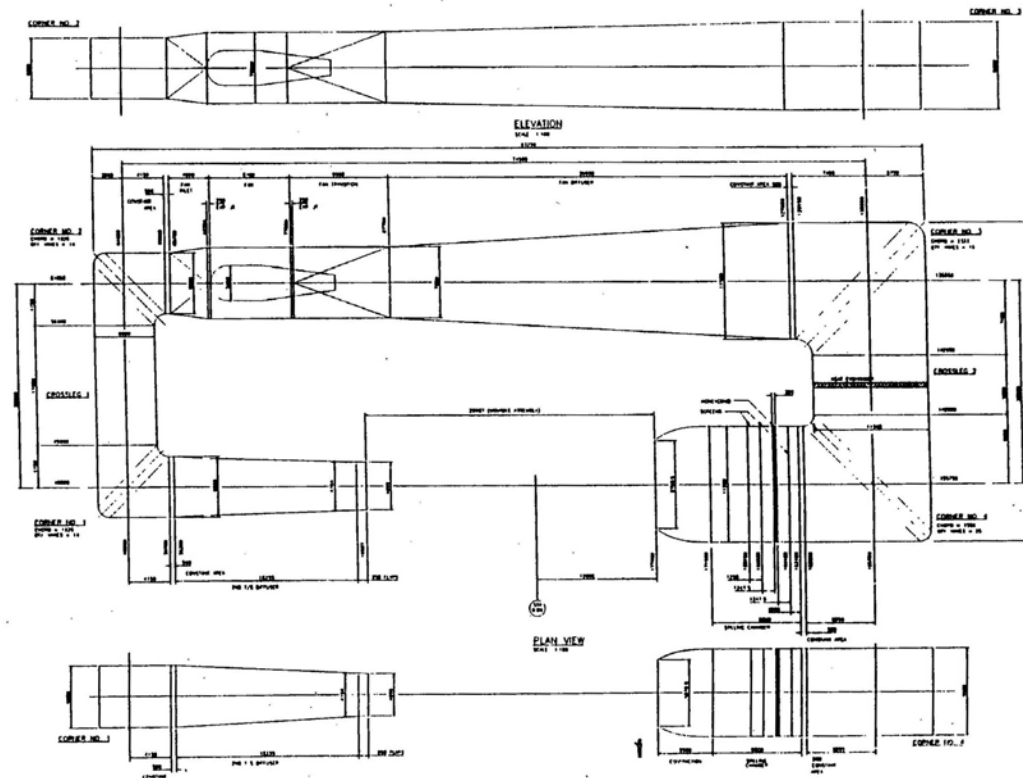


Figure 7.1-1 KARI – LSWT Schematic

**4 m Low-Speed Wind Tunnel (LSWT), Korea Aerospace Research Institute (KARI), Daejeong, Korea**

# European and Asian Wind Tunnels

Subsonic

Korea (South)

Installation Name	Test Section Size	Speed Range
Korea Aerospace Research Institute (KARI), Daejeon, Republic of Korea	1 x 0.75 x 2 m (solid wall, rectangular)	110 m/s (max)
		Temperature Range
	Date Built/Upgrade	
Facility Name	1993	Reynolds Number (million)
KARI 1 m Wind Tunnel		
	Cost	Dynamic Pressure
	USD \$427,965 (construction cost in 1993 KRW, Jan 2006 conversion rate: 1USD=981.389 KRW)	
	Operational Status	Stagnation Pressure
	Assumed active per personal correspondence 1/15/06.	

## Supplementary Technical Parameters

Contraction ratio: 11.5, Fan: 2 m diameter, 250 kW.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Mr. Kijung Kwon (Manager), Korea Aerospace Research Institute, Korea Aerospace Research Institute, 45 Uh-Eun-Dong Eusung-Gu, Daejeon, ROK.  
Tel: (82) 42 860 2318, E-mail: [kjkwon@kari.re.kr](mailto:kjkwon@kari.re.kr), Web site: <http://adg.kari.re.kr/index.jsp>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Subsonic

Korea (South)

Installation Name	Test Section Size	Speed Range
Korea Aerospace Research Institute (KARI), Dae-Jeon, Republic of Korea	4 x 3 x 10 m (solid wall, rectangular)	110 m/s (max)
		Temperature Range
	Date Built/Upgrade	
Facility Name	1998	Reynolds Number (million)
KARI Low Speed Wind Tunnel (LSWT)		
	Cost	Dynamic Pressure
	USD \$17,612,356 (construction cost in 1998 KRW, Jan 2006 conversion rate: 1USD=981.697 KRW)	
	Operational Status	Stagnation Pressure
	Assumed active per personal correspondence 1/15/06.	

## Supplementary Technical Parameters

Contraction ratio: 8.24, Fan: 7 m diameter, 4100 kW.

## Data Acquisition

## Testing Capabilities/Current Programs

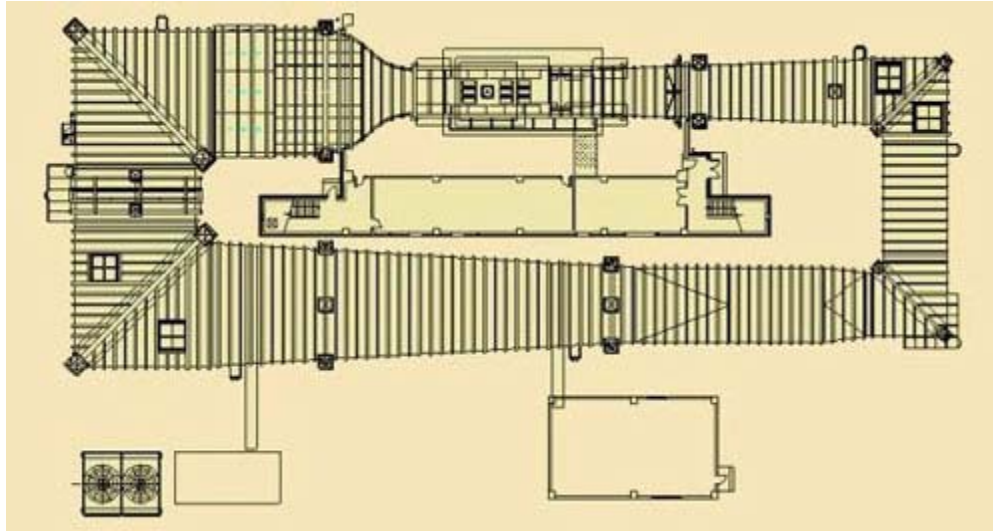
## Planned Improvements

## User Fees

## Contact Information

Dr. Byeonghee Jang (Manager), Korea Aerospace Research Institute, 45 Uh-Eun-Dong Eusung-Gu, Daejeon, ROK.  
Tel: (82) 42 860 2313, E-mail: cbh@kari.re.kr, Web site: <http://adg.kari.kr.kr/index.jsp>.

## European and Asian Wind Tunnels



**KARI LSWT, Korea Aerospace Research Institute, Daejeon,  
South Korea (ROK).**



# European and Asian Wind Tunnels

Subsonic

Korea (South)

Installation Name	Test Section Size	Speed Range
Korea Air Force Academy (KAFA), KAFA Subsonic Wind Tunnel Laboratory, Choongbuk, Republic of Korea	3.5 x 2.45 x 8.7 m (solid wall, rectangular)	92 m/s (max)
		Temperature Range
	Date Built/Upgrade	
Facility Name	1999	Reynolds Number (million)
KAFA Low Speed Wind Tunnel (LSWT)	Cost	
	USD \$12,768,179 (construction cost in 1999 KRW, Jan 2006 conversion rate: 1USD=980.093 KRW)	Dynamic Pressure
	Operational Status	Stagnation Pressure
	Assumed active per personal correspondence 1/15/06.	

## Supplementary Technical Parameters

Circuit: closed. Contraction ratio: 7.26. Fan: 5.25 m diameter, 2100 kW.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Dr. Hyungsuck Chung (Manager), Department of Aerospace Engineering, Korea Air Force Academy, Choong-Book Chung-Won-Koon, Nam-Il-Myun Ssang-Soo-Ri, Sa Seo Ham 335-1, ROK.

Tel: (82) 043 290 6462/6176, Email: [hschung@afa.ac.kr](mailto:hschung@afa.ac.kr), Web site: [http://www.afa.ac.kr/index\\_new.htm](http://www.afa.ac.kr/index_new.htm).

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Subsonic

Korea (South)

Installation Name	Test Section Size	Speed Range
Korea Air Force Academy (KAFA), KAFA Subsonic Wind Tunnel Laboratory, Choongbuk, Republic of Korea	#1: 3.5 x 2.45 x 8.7 m (closed); #2: 5.25 x 3.67 x 13.0 m (closed)	#1: 0.27 Mach; #2: 0.11 Mach
		Temperature Range
	Date Built/Upgrade	
Facility Name	August 5, 1999	Reynolds Number (million)
KAFA Subsonic Wind Tunnel	Cost	#1: 6.2; #2: 2.7
	US\$15 million (estimated)	Dynamic Pressure
	Operational Status	
	Presumed active as of November 2005	Stagnation Pressure
		Atmospheric

## Supplementary Technical Parameters

The KAFA Subsonic wind tunnel features a closed circuit with interchangeable test section, main section, future larger secondary test section, slotted wall and open-jet test sections, conservative airlines, honeycomb flow straightener, and anti-turbulence screens, fixed-location elevating external balance, model support strut, articulated sting, test section cart system, floor boundary layer removal, temperature control, heat exchange, flow survey mechanism, air exchange.

## Data Acquisition

Jacobs Sverdrup's PC-based software

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Dr. Myong Sohn, KAFA Subsonic Wind Tunnel Lab, Sang Su-Ri 335-2 NamIl-Myun, Cheong Won-Gun Chung Buk 363-849, ROK  
Tel: (82) 43 290 6160/6050, Fax: (82) 43 297 8109, Email: afalswt@mail.afa.ac.kr.

# European and Asian Wind Tunnels

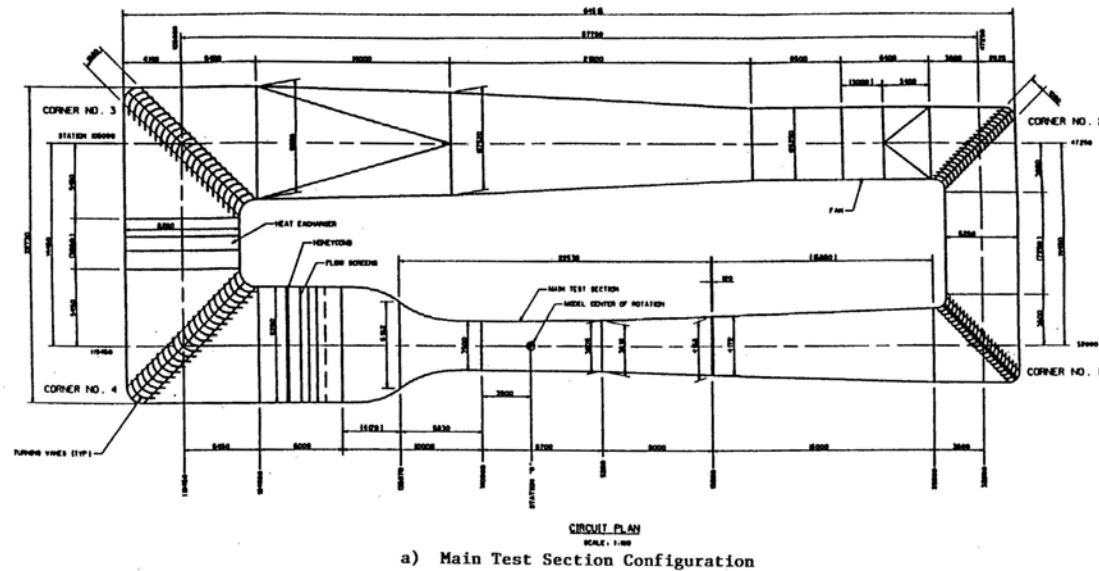


Figure 7.1-2 KAFA Subsonic Wind Tunnel

**Subsonic Wind Tunnel, Korea Air Force Academy (KAFA), KAFA Subsonic Wind Tunnel Lab, Choongbuk, Korea.**

# European and Asian Wind Tunnels

Subsonic

Korea (South)

Installation Name	Test Section Size	Speed Range
Kyeongsang National University, School of Mechanical and Aerospace Engineering, Jinjoo, Republic of Korea	1 x 1 x 3 m (solid wall, square)	60 m/s (max)
		Temperature Range
	Date Built/Upgrade	
Facility Name	2002	Reynolds Number (million)
Multi-Purpose Small Wind Tunnel		
	Cost	Dynamic Pressure
	US\$3,564 (construction cost in 2002 KRW, Jan 2006 conversion rate: 1USD=981.392 KRW)	
	Operational Status	Stagnation Pressure
	Assumed active per personal correspondence 1/15/06.	

## Supplementary Technical Parameters

Contraction ratio: 7.2. Fan: 2 m diameter, 130 kW.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Dr. Sooyong Cho (Manager), School of Mechanical and Aerospace Engineering, Kyeongsang National University, Kyeongnam Jinjoo-Shi, Gagoa-Dong 900 Mechanical and Aerospace Engineering Unit BK21 660-701, ROK.

Tel: (82) 055 751 6106, E-mail: [aero@gsnu.ac.kr](mailto:aero@gsnu.ac.kr), Email (Cho): [sycho@nongae.gsnu.ac.kr](mailto:sycho@nongae.gsnu.ac.kr), Web site: <http://engine.gsnu.ac.kr>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Subsonic

Korea (South)

Installation Name	Test Section Size	Speed Range
Pohang University of Science and Technology, Pohang, Republic of Korea	1.8 x 1.5 x 4.3 m (solid wall, rectangular)	75 m/s (max)
		Temperature Range
	Date Built/Upgrade	
Facility Name	1995	Reynolds Number (million)
Medium-Sized Subsonic Wind Tunnel		
	Cost	Dynamic Pressure
	US\$1,018,792 (construction cost in 1995 KRW, Jan 2006 conversion rate: 1USD=981.555 KRW)	
	Operational Status	Stagnation Pressure
	Assumed active per personal correspondence 1/15/06.	

## Supplementary Technical Parameters

Contraction ratio: 9. Fan: 3.4 m diameter, 260 kW.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Dr. Sangjoon Lee (Manager), Pohang University of Science and Technology, San 31, Hyoja-Dong, Nam Gu, Pohang, Gyungbuk, ROK.  
Tel: (82) 54 279 0114, Fax: (82) 54 279 2099, E-mail: sjlee@postech.ac.kr, Web site: <http://www.postech.ac.kr/new/e/>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**



# European and Asian Wind Tunnels

Subsonic

Korea (South)

Installation Name	Test Section Size	Speed Range
Pohang University of Science and Technology, Pohang, Republic of Korea	0.72 x 0.6 x 2.5 m (solid wall, rectangular)	40 m/s (max)
		Temperature Range
	Date Built/Upgrade	
Facility Name	1990	Reynolds Number (million)
Small Subsonic Wind Tunnel		
	Cost	Dynamic Pressure
	Operational Status	Stagnation Pressure
	Assumed active per personal correspondence 1/15/06.	

## Supplementary Technical Parameters

Contraction ratio: 9. Fan: 1.5 m diameter, 100 kW.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Dr. Sangjoon Lee (Manager), Pohang University of Science and Technology, San 31, Hyoja-Dong, Nam Gu, Pohang, Gyungbuk, ROK.  
Tel: (82) 54 279 0114, Fax: (82) 54 279 2099, E-mail: sjlee@postech.ac.kr, Web site: <http://www.postech.ac.kr/new/e/>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Subsonic

Korea (South)

Installation Name	Test Section Size	Speed Range
Pusan National University, Department of Aerospace Engineering, Pusan, Republic of Korea	0.7 x 0.7 x 2 m (solid wall, square)	60 m/s (max)
		Temperature Range
	Date Built/Upgrade	
Facility Name	1992	Reynolds Number (million)
Subsonic Wind Tunnel	Cost	
	US\$72,929 (construction cost in 1992 KRW, Jan 2006 conversion rate: 1USD=980.403 KRW)	Dynamic Pressure
	Operational Status	
	Assumed active per personal correspondence 1/15/06.	Stagnation Pressure

## Supplementary Technical Parameters

Contraction ratio: 6.6. Fan: 0.68 m diameter, 75 kW.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Dr. Kyunchun Kim (Manager), Department of Aerospace Engineering, Pusan National University, Geum-Jeong-Koo, Pusan, 609-735, ROK.  
Tel: (82) 51 510 2324, E-mail: kckim@pusan.ac.kr, Web site: <http://aerospace.ae.pusan.ac.kr>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Subsonic

Korea (South)

Installation Name	Test Section Size	Speed Range
Sejong University, Seoul, Republic of Korea	0.3 x 0.3 x 1 m (open, square)	35 m/s (max)
		Temperature Range
	Date Built/Upgrade	
Facility Name	2000	Reynolds Number (million)
Small Subsonic Wind Tunnel	Cost	
	US\$30,552 (construction cost in 2000 KRW, Jan 2006 conversion rate: 1USD=981.940 KRW)	Dynamic Pressure
	Operational Status	
	Assumed active per personal correspondence 1/15/06.	Stagnation Pressure

## Supplementary Technical Parameters

Circuit: blowing. Contraction ratio: 9. Fan: 0.3 m diameter, 3.7 kW.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Dr. Kyungtae Lee (Manager), Sejong University, Kwang-Jin-Gu Goon-Ja-Dong, Choong-Moo-Kwan #410, 143-747, Seoul, ROK.  
Tel: (82) 2 3408 3285, E-mail: kntlee@sejong.ac.kr, Web site: <http://www.sejong.ac.kr/eng/>, <http://dasan.sejong.ac.kr/~slmarc/kntlee/>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Subsonic

Korea (South)

Installation Name	Test Section Size	Speed Range
Seoul National University, Department of Mechanical Engineering, Seoul, Republic of Korea	1.35 x 0.95 x 2.44 m (solid wall, rectangular)	70 m/s (max)
		Temperature Range
	Date Built/Upgrade	
Facility Name	1961	Reynolds Number (million)
Aerospace Engineering Wind Tunnel	Cost	
		Dynamic Pressure
	Operational Status	
	Assumed active per personal correspondence 1/15/06.	Stagnation Pressure

## Supplementary Technical Parameters

Circuit: closed. Contraction ratio: 6.16. Fan: 1.8 m diameter, 56 kW.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Dr. Chongnam Kim (Manager), Department of Mechanical Engineering, Seoul National University, Kwan-Ak-Koo Shin-Rhim 9-Dong San 56-1 Mechanical Engineering Unit301 #116,151-744, Seoul, ROK.

Tel: (82) 2 880 1915, Fax: 82 2 880 1910, E-mail: chongnam@plaza.snu.ac.kr, Web site: <http://mae.snu.ac.kr/eng/default.asp>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**



# European and Asian Wind Tunnels

Subsonic

Korea (South)

Installation Name	Test Section Size	Speed Range
Ulsan University, Ulsan, Republic of Korea	2 x 1.8 x 10 m (solid wall, rectangular)	35 m/s (max)
		Temperature Range
	Date Built/Upgrade	
Facility Name	1999	Reynolds Number (million)
Multi-Purpose Wind/Water Tunnel		
	Cost	Dynamic Pressure
	US\$407,550 (construction cost in 1999 KRW, Jan 2006 conversion rate: 1USD= 981.392 KRW)	
	Operational Status	Stagnation Pressure
	Assumed active per personal correspondence 1/15/06.	

## Supplementary Technical Parameters

Circuit: suction. Contraction ratio: 4. Fan: 2.6 m diameter, 117 kW.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Dr. Donghwan Lee (Manager), Ulsan University, 680-749 San 29, Muger 2-Dong, Ulsan, ROK.  
Tel: (82) 52 277 3101, E-mail: webmaster@mail.ulsan.ac.kr, Web site: <http://www.ulsan.ac.kr/>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Subsonic

Malaysia

Installation Name	Test Section Size	Speed Range
Technological University of Malaysia, Faculty of Mechanical Engineering, Aeronautical Laboratory, Johor, Malaysia	1.5 x 2 x 5.8 m (solid wall, interchangeable)	3 to 80 m/s (max)
		Temperature Range
	Date Built/Upgrade	
Facility Name	May 2001	Reynolds Number (million)
UTM Low Speed Wind Tunnel (UTM-LST)		1
	Cost	Dynamic Pressure
	US\$7 million (estimated construction cost)	
	Operational Status	Stagnation Pressure
	Presumed active as of December 2005	Atmospheric

## Supplementary Technical Parameters

Closed-return type, continuous, atmospheric, horizontal-arrangement, contraction ratio 9.

## Data Acquisition

Pacific Instrument PI 6000 Series Data Acquisition System, Pre-test, Test, Post-Test Analysis/Calibration, Windows 2000/NT OS.

## Testing Capabilities/Current Programs

Static flight characteristics of aircraft in low speed regime, including computational fluid dynamics (CFD) code validation, determination of aircraft derivatives, and aerodynamics of special problems (automotive, building structures, etc). Support to aeronautical education. Aircraft aerodynamic (3-D model aircraft testing), automotive/ground vehicle aerodynamics wind engineering, half-model testing, airfoil testing, aerodynamic derivative testing.

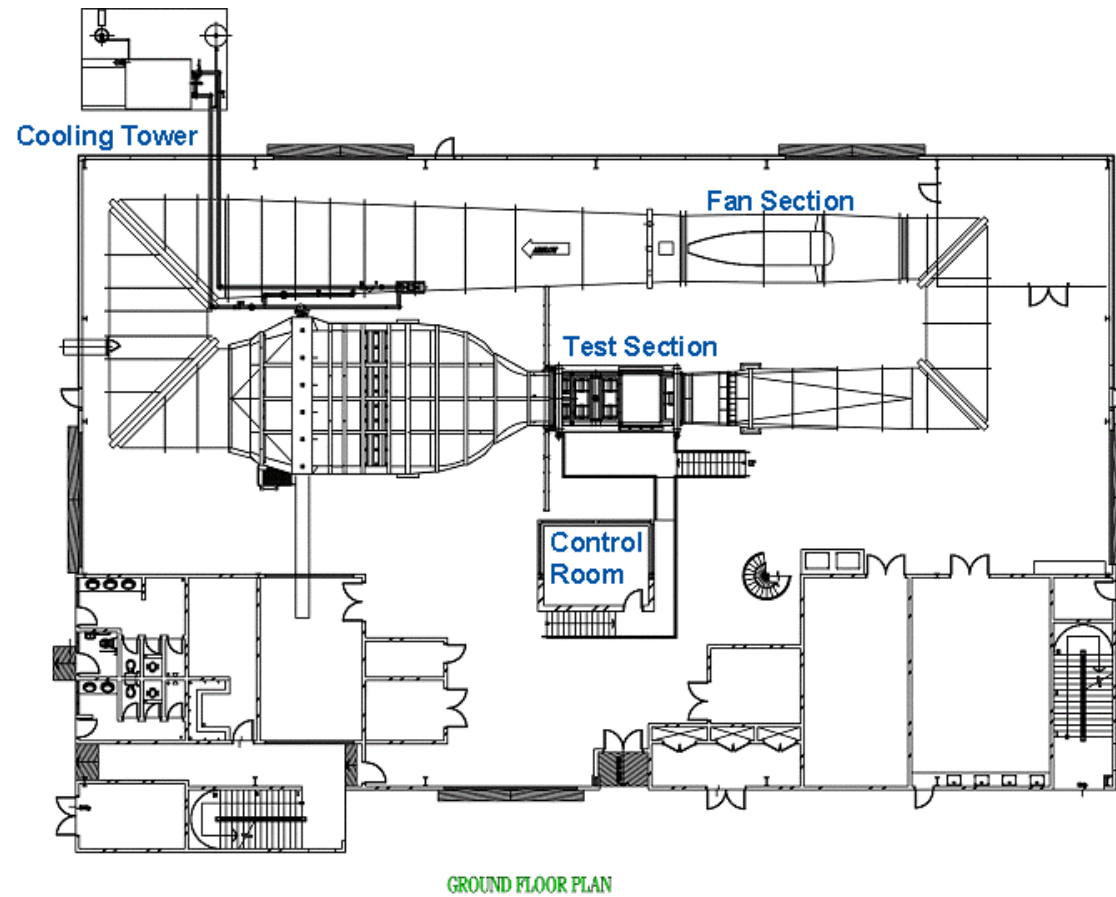
## Planned Improvements

## User Fees

## Contact Information

Mohd Khir Muhammad (Head of Aero Laboratory), Faculty of Mechanical Engineering, Universiti Teknologi Malaysia, 81310 UTM Skudai, Johor, Malaysia.  
Tel: (60) 7550 5642/4857, Fax: (60) 7 556 6159, Email: aerolab@fkm.utm.my, Web site: <http://www.fkm.utm.my/aerolab/>.

## European and Asian Wind Tunnels



**UTM Low-Speed Wind Tunnel Aeronautical Laboratory, Technological University of Malaysia, Johor, Malaysia**

# European and Asian Wind Tunnels

Subsonic

Netherlands

Installation Name	Test Section Size	Speed Range
Delft University of Technology (TUDELFT), Delft, The Netherlands	1.25 x 0.25 m	0.15 Mach
		Temperature Range
	Date Built/Upgrade	
Facility Name		Reynolds Number (million)
Boundary Layer Wind Tunnel	Cost	
		Dynamic Pressure
	Operational Status	
	Presumed active as of October 2005	Stagnation Pressure
		Gradient

## Supplementary Technical Parameters

Closed-circuit, low-speed wind tunnel. Flexible wall with suction slits for control of pressure gradient.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Low-Speed Laboratory, Delft University of Technology (TUDELFT), Leeghwaterstraat 42, 2628 CA Delft, The Netherlands.  
Tel: (31) 15 2781320, Fax: (31) 15 2783533, Web site: [http://www.hsa.lr.tudelft.nl/ae\\_facilities\\_fr.html](http://www.hsa.lr.tudelft.nl/ae_facilities_fr.html).

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Subsonic

Netherlands

Installation Name	Test Section Size	Speed Range
Delft University of Technology (TUDELFT), Low Speed Laboratory, Delft, The Netherlands	1.25 x 1.80 m	0.35 Mach
		Temperature Range
	Date Built/Upgrade	
Facility Name		Reynolds Number (million)
Subsonic Low-Turbulence Wind Tunnel	Cost	
		Dynamic Pressure
	Operational Status	
	Presumed active as of October 2005	Stagnation Pressure

## Supplementary Technical Parameters

Closed circuit. Turbulence level < 0.1%, six component balance, automatic multi-manometer.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Low Speed Laboratory, Delft University of Technology (TUDELFT), Leeghwaterstraat 42, 2628 CA Delft, The Netherlands.  
Tel: (31) 15 2781320, Fax: (31) 15 2783533, Web site: [http://www.hsa.lr.tudelft.nl/ae\\_facilities\\_fr.html](http://www.hsa.lr.tudelft.nl/ae_facilities_fr.html).

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**



# European and Asian Wind Tunnels

Subsonic

Netherlands

Installation Name	Test Section Size	Speed Range
German-Dutch Wind Tunnels (DNW), NOP Business Unit, Emmeloord, The Netherlands	#1: 6.0 x 6.0 m (closed or slotted walls); #2: 8.0 x 6.0 m (closed or slotted walls); #3: 8.0 x 6.0 m (open jet); #4: 9.5 x 9.5 m (closed walls)	#1: 152 m/s (max); #2: 116 m/s (max); #3: 85 m/s (max) ; #4: 62 m/s (max)
		Temperature Range
	Date Built/Upgrade	
Facility Name	1980	Reynolds Number (million)
Large Low Speed Wind Tunnel (LLF)	Cost	#1: 6.0; #2: 5.3; #3: 3.9; #4: 3.9
		Dynamic Pressure
	Operational Status	Stagnation Pressure
	Presumed active as of September 2005	

## Supplementary Technical Parameters

Continuous, closed-return, atmospheric wind tunnel. Largest low-speed atmospheric wind tunnel in Europe. One open-jet configuration in large anechoic testing hall, single-stage fan with 8 non-adjustable blades of 12.35 m diameter. Direct drive, variable speed synchronous electric motor (12.65 MW, 225 rpm). Intermittent air exchange and throttle system.

## Data Acquisition

On-/off-line static and dynamic data acquisition and processing systems. Image processing system. Acoustic data processing and analyzing system.

## Testing Capabilities/Current Programs

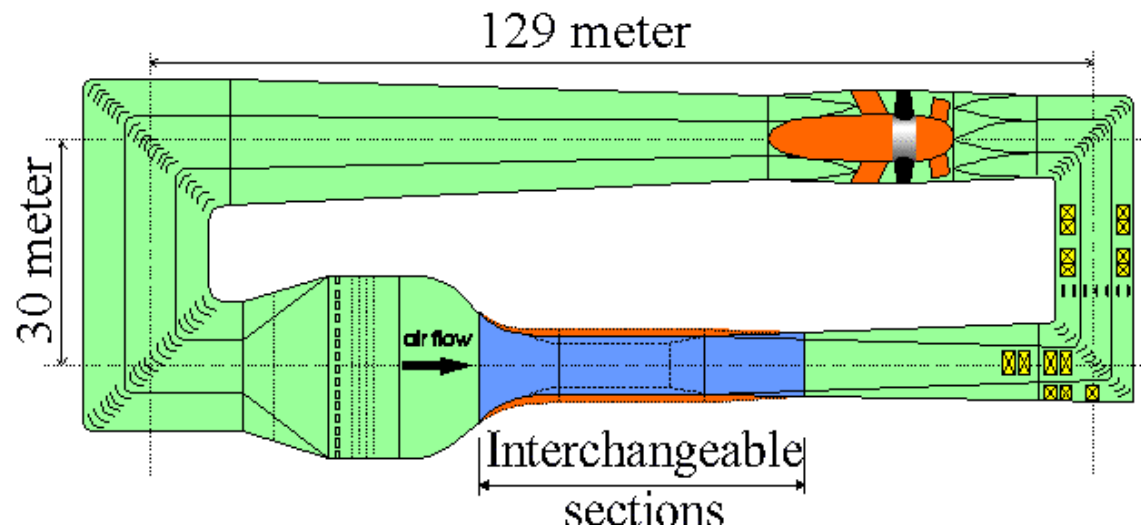
## Planned Improvements

## User Fees

## Contact Information

Ir. G.H. Hegen, German-Dutch Wind Tunnels (DNW), PO Box 175, 8300 AD Emmeloord, The Netherlands.  
Tel: (31) 527 24 8519, Fax: (31) 527 24 8582, Email: [info@dnw.aero](mailto:info@dnw.aero), Web site: <http://www.dnw.aero/>.

## European and Asian Wind Tunnels



**Large Low-Speed Wind Tunnel (LLF), German-Dutch Wind Tunnels (DNW), Emmeloord, The Netherlands.**

# European and Asian Wind Tunnels

Subsonic

Netherlands

Installation Name	Test Section Size	Speed Range
German-Dutch Wind Tunnels (DNW), NOP Business Unit, Emmeloord, The Netherlands	3.0 x 2.25 m (closed walls)	80 m/s (max)
		Temperature Range
	Date Built/Upgrade	
Facility Name	1983	Reynolds Number (million)
Low Speed Wind Tunnel (LST)	Cost	1.4
		Dynamic Pressure
	Operational Status	
	Presumed active as of September 2005	Stagnation Pressure

## Supplementary Technical Parameters

Continuous atmospheric wind tunnel. Closed return circuit, atmospheric pressure, two interchangeable test sections. Single-stage fan with eight non-adjustable blades. Direct drive, variable speed, 700-kW electric motor. Contraction ratio 1:9.

## Data Acquisition

64 measuring channels.

## Testing Capabilities/Current Programs

Testing of aircraft models, windfields around buildings or helicopter decks on ships. Ground effect simulation.

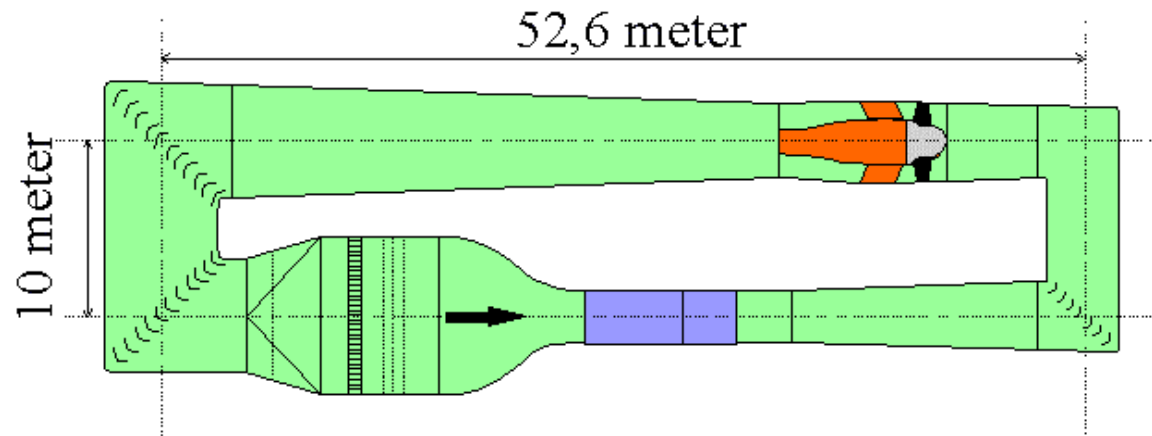
## Planned Improvements

## User Fees

## Contact Information

Ir. G.H. Hegen, German-Dutch Wind Tunnels (DNW), PO Box 175, 8300 AD Emmeloord, The Netherlands.  
Wind tunnel located at Voorsterweg 31, 8316 PR Markesse, Netherlands.  
Tel: (31) 527 24 8519, Fax: (31) 527 24 8582, Email: [info@dnw.aero](mailto:info@dnw.aero), Web site: <http://www.dnw.aero/>.

## European and Asian Wind Tunnels



**Low-Speed Wind Tunnel (LST), German-Dutch Wind Tunnels (DNW), Emmeloord, The Netherlands.**

# European and Asian Wind Tunnels

Subsonic

Scotland

Installation Name	Test Section Size	Speed Range
University of Glasgow, Department of Aerospace Engineering, Glasgow, Scotland	1.15 x 0.95 m	30 m/s (max)
		Temperature Range
	Date Built/Upgrade	
Facility Name		Reynolds Number (million)
1.15 x 0.95 m Low Speed Wind Tunnel	Cost	
		Dynamic Pressure
	Operational Status	
	Presumed active as of October 2005	Stagnation Pressure

## Supplementary Technical Parameters

Closed-return facility. Three-component mechanical balance. Rotary vortex generator for helicopter rotor wake simulation.

## Data Acquisition

200-channel parallel data acquisition system, 50 kHz per channel. Automatic gain setting and offset removal for maximum sensitivity. Digital PIV system based on two Nd-Yag lasers and two Kodak Megaplug digital cameras. Three-channel TSI IFA 300 constant temperature anemometer system w/ DISA probes and supports.

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Dr. D.G. Thomson (Head), Department of Aerospace Engineering, University of Glasgow, James Watt Building, Glasgow G12 8QQ, Scotland, UK.  
Tel: (44) 41 330-3575, Fax: (44) 41 330-5560, Web site: <http://www.aero.gla.ac.uk/Research/LowSpeedAero/facilities.htm>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Subsonic

Scotland

Installation Name	Test Section Size	Speed Range
University of Glasgow, Department of Aerospace Engineering, Glasgow, Scotland	2.65 x 2.04 m	76 m/s (max)
		Temperature Range
	Date Built/Upgrade	
Facility Name		Reynolds Number (million)
Argyll Wind Tunnel	Cost	
		Dynamic Pressure
	Operational Status	
		Stagnation Pressure

## Supplementary Technical Parameters

The Argyll is a closed-return wind tunnel with two interchangeable working sections. A yawing capability up to 10° included. Rotary vortex generator and a mechanical six-component balance.

## Data Acquisition

200-channel parallel data acquisition system, 50 kHz per channel, automatic gain setting and offset removal for maximum sensitivity. Digital PIV system based on two Nd-Yag lasers and two Kodak Megaplug digital cameras. Three-channel TSI IFA 300 constant temperature anemometer system w/ DISA probes and supports.

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Dr. D.G. Thomson (Head), Department of Aerospace Engineering, University of Glasgow, James Watt Building, Glasgow G12 8QQ, Scotland, UK.  
Tel: (44) 41 330-3575, Fax: (44) 41 330-5560, Web site: <http://www.aero.gla.ac.uk/Research/LowSpeedAero/facilities.htm>.

## European and Asian Wind Tunnels



**Argyll Wind Tunnel, University of Glasgow, Department of Aeronautical Engineering, Glasgow, Scotland.**



# European and Asian Wind Tunnels

Subsonic

Scotland

Installation Name	Test Section Size	Speed Range
University of Glasgow, Department of Aerospace Engineering, Glasgow, Scotland	2.13 x 1.61 m	60 m/s (max)
		Temperature Range
	Date Built/Upgrade	
Facility Name		Reynolds Number (million)
Handley-Page Wind Tunnel	Cost	
		Dynamic Pressure
	Operational Status	
	Presumed active as of October 2005	Stagnation Pressure

## Supplementary Technical Parameters

The wind tunnel features three-strut hydraulic system. Closed return.

## Data Acquisition

200-channel parallel data acquisition system, 50 kHz per channel, automatic gain setting and offset removal for maximum sensitivity. Digital PIV system based on two Nd-Yag lasers and two Kodak Megaplug digital cameras. Three-channel TSI IFA 300 constant temperature anemometer system w/ DISA probes and supports.

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Dr. D.G. Thomson (Head), Department of Aeronautical Engineering, University of Glasgow, James Watt Building, Glasgow G12 8QQ, Scotland, UK.  
Tel: (44) 41 330-3575, Fax: (44) 41 330-5560, Web site: <http://www.aero.gla.ac.uk/Research/LowSpeedAero/facilities.htm>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Subsonic

Sweden

<b>Installation Name</b>	<b>Test Section Size</b>	<b>Speed Range</b>
Swedish Defense Reseach Agency, FOI, Stockholm, Sweden	3.6 m (diameter), 8 m (long)	0.23 Mach
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	Ambient
<b>Facility Name</b>	1940	<b>Reynolds Number (million)</b>
LT1 Subsonic Wind Tunnel		1.8
	<b>Cost</b>	<b>Dynamic Pressure</b>
	<b>Operational Status</b>	<b>Stagnation Pressure</b>
	Presumed active as of October 2005	Ambient

## Supplementary Technical Parameters

### Data Acquisition

64 channels, 15 bit AD, 180 kHz VAX 750 data system.

### Testing Capabilities/Current Programs

Aeronautics, ground transporation, buildings, roll rotation, intake suction.

### Planned Improvements

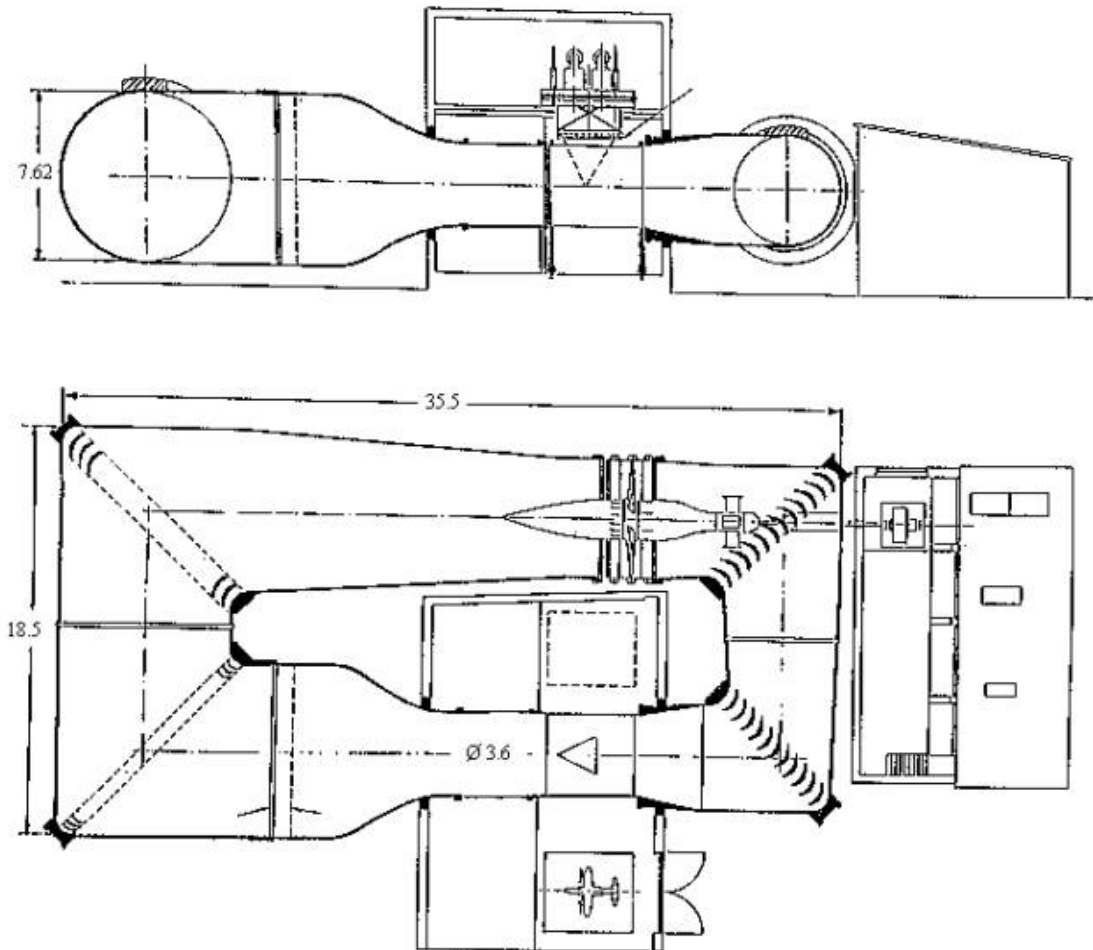
### User Fees

### Contact Information

Bengt Hultqvist (Head), Experimental Aerodynamics, Swedish Defence Research Agency, SE-164 90 Stockholm, Sweden.

Tel (Hultqvist): (46) 8 555 043 39, Tel (Main): (46) 8 555 030 00, Fax: (46) 8 555 031 00, Email (Hultqvist): [bengt.hultqvist@foi.se](mailto:bengt.hultqvist@foi.se), Web site: <http://www.foi.se/>.

## European and Asian Wind Tunnels



**Subsonic Wind Tunnel (LT1), Swedish Defense Research Agency (FOI), Stockholm, Sweden.**

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# European and Asian Wind Tunnels

Transonic

China

Installation Name	Test Section Size	Speed Range
Aerospace Science and Technology Research Center, National Cheng Kung University, Taiwan, China		
		Temperature Range
	Date Built/Upgrade	
Facility Name		Reynolds Number (million)
Transonic Wind Tunnel	Cost	
		Dynamic Pressure
	Operational Status	
	Presumed active as of November 2005	Stagnation Pressure

## Supplementary Technical Parameters

## Data Acquisition

## Testing Capabilities/Current Programs

Aerodynamic characteristics of regional jets, development of high-speed gas dynamics, aerodynamic design of high-speed trains, CFD verification, shock and boundary layer interactions.

## Planned Improvements

## User Fees

## Contact Information

National Cheng Kung University, No.1, Ta-Hsueh Road, Tainan 701, Taiwan, China.  
Tel: (886) 6 275 7575, Web site: [http://www.ncku.edu.tw/english/about\\_ncku/research\\_services.htm](http://www.ncku.edu.tw/english/about_ncku/research_services.htm).

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Transonic

China

Installation Name	Test Section Size	Speed Range
China Academy of Aerospace Aerodynamics (CAAA), Beijing, China AKA: Beijing Institute of Aerodynamics (BIA) or 701st Institute of the China Aerospace Science & Technology Corporation (CASC)	0.76 x 0.53 m	0.3 to 1.15 Mach
		Temperature Range
	Date Built/Upgrade	
Facility Name		Reynolds Number (million)
Transonic Wind Tunnel	Cost	
		Dynamic Pressure
	Operational Status	
	Presumed active as of November 2005	Stagnation Pressure

## Supplementary Technical Parameters

Continuous flow with the flow field characterized by high uniformity, low turbulence intensity, low noise.

## Data Acquisition

## Testing Capabilities/Current Programs

Measurement of pressure and forces on aircraft models, flutter and buffeting tests, dynamic derivative tests, aircraft-missile interference tests, hinge moment measurement, and air inlet model tests.

## Planned Improvements

## User Fees

## Contact Information

Li Feng (Director), China Academy of Aerospace Aerodynamics (CAAA), 17 Yungang West Road, Fengtai District, Beijing 100074, China.  
Tel: (86) 10 68740603, Fax: (86) 10 68374758, Email: caaa@bia701.com, Web site: [http://www.bia701.com/HRML/e\\_16\\_fd08\\_01.htm](http://www.bia701.com/HRML/e_16_fd08_01.htm).



## European and Asian Wind Tunnels



**Transonic Wind Tunnel,  
China Academy of Aerospace Aerodynamics (CAAA),  
Beijing, China**

# European and Asian Wind Tunnels

Transonic

China

Installation Name	Test Section Size	Speed Range
China Aerodynamics Research and Development Center (CARD C), Mianyang City, Sichuan Province, China	2.4 x 2.4 m	0.3 to 1.2 Mach
		Temperature Range
	Date Built/Upgrade	
Facility Name	1997/1998 (upgrade)	Reynolds Number (million)
2.4 m Transonic Wind Tunnel	Cost	40 to 70
		Dynamic Pressure
		4.5 atmospheric (max)
	Operational Status	Stagnation Pressure
	Presumed active as of November 2005	

## Supplementary Technical Parameters

Wind tunnel is 66 m long x 33 m wide. China claims this to be the largest transonic wind tunnel in Asia. Manufactured by Swedish Defense Research Agency (FOI), Stockholm, Sweden.

## Data Acquisition

## Testing Capabilities/Current Programs

Research and development of aerospace flight vehicles.

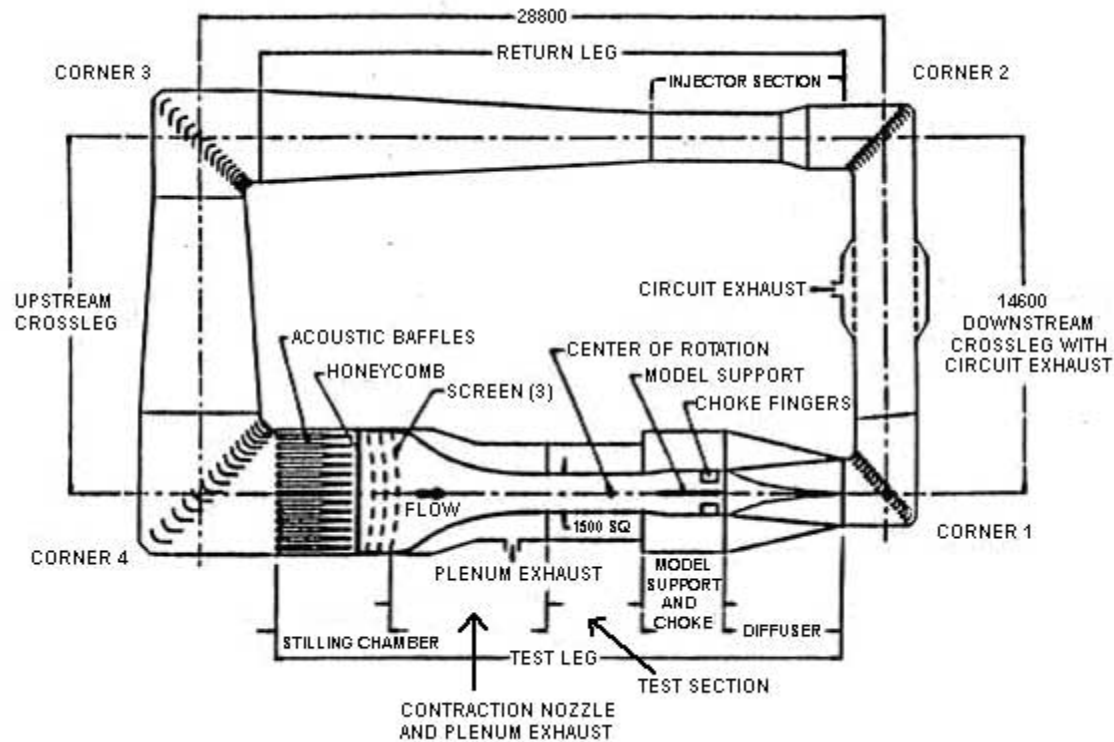
## Planned Improvements

## User Fees

## Contact Information

Shang Shouhong (Dean), China Aerodynamics Research and Development Center Graduate School, PO Box 211, Mianyang City, Sichuan Province 621000, China.  
Tel: (86) 816 246 3053, Fax: (86) 816 246 3051, Email: ssh@cardcgs.com, Web site: <http://www.cardcgs.com/cardcgs/index.asp>,  
<http://www.cardcgs.com/default2.asp>

## European and Asian Wind Tunnels



Note: CARDC 2.4 m is a scaled version of the tunnel, FFA T1500 Transonic Wind Tunnel Circuit (Sweden) manufactured by The Swedish Defense Research Agency (FOI).

**2.4 m Transonic Wind Tunnel, China Aerodynamics Research and Development Center (CARDC), Mianyang, China.**

# European and Asian Wind Tunnels

Transonic

China

Installation Name	Test Section Size	Speed Range
China Aerodynamics Research and Development Center (CARD C), Mianyang City, Sichuan Province, China		
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	100 to 148°K
<b>Facility Name</b>	1998	<b>Reynolds Number (million)</b>
Low Temperature Compressed Air Transonic Wind Tunnel	<b>Cost</b>	
		<b>Dynamic Pressure</b>
	<b>Operational Status</b>	
	Prototype, not yet operational	<b>Stagnation Pressure</b>
		10.6 bar

## Supplementary Technical Parameters

Refrigeration system uses liquid nitrogen.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Shang Shouhong (Dean), China Aerodynamics Research and Development Center Graduate School, PO Box 211, Mianyang City, Sichuan Province 621000, China.  
Tel: (86) 816 2463053, Fax:( 86) 816 246 3051, Email: ssh@cardcgs.com, Web site: <http://www.cardcgs.com/cardcgs/index.asp>,  
<http://www.cardcgs.com/default2.asp>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Transonic

China

Installation Name	Test Section Size	Speed Range
Chinese Aerodynamics Research Institute of Aeronautics (CARIA), Harbin, Heilongjiang Province, China		
		Temperature Range
	Date Built/Upgrade	
Facility Name		Reynolds Number (million)
FL-3 High-Speed Air-Inlet Test Platform		
	Cost	
		Dynamic Pressure
	Operational Status	
	Presumed active as of November 2005	Stagnation Pressure

## Supplementary Technical Parameters

Test platform serves as a special-use experimental wind tunnel with a sub- and transonic air inlet.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Professor Yu Tao (Director), Chinese Aerodynamic Research Institute of Aeronautics (CARIA), PO Box 88, 2 Yiman Street, Harbin, Heilongjiang Province, China 150001.

Tel: (86) 451 82539364, Fax: (86) 451 82838327, Email: [cph@caria.com.cn](mailto:cph@caria.com.cn), Web site: <http://www.caria.com.cn>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Transonic

England

<b>Installation Name</b>	<b>Test Section Size</b>	<b>Speed Range</b>
Aircraft Research Association Limited (ARA), Bedford, England	2.74 x 2.44 m	0.2 to 1.4 Mach
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	Ambient
<b>Facility Name</b>		<b>Reynolds Number (million)</b>
Transonic Wind Tunnel (TWT)	<b>Cost</b>	13, 17
		<b>Dynamic Pressure</b>
	<b>Operational Status</b>	
	Presumed active as of October 2005. 24-hour operation.	<b>Stagnation Pressure</b>
		0.8 to 1.2 bar

## Supplementary Technical Parameters

Continuous-flow, closed-circuit tunnel driven primarily by the main fan with additional speed provided by a compressor. Incidence range of  $-10^{\circ}$  to  $+40^{\circ}$ , roll range  $0^{\circ}$  to  $360^{\circ}$ , maximum model length 1.83 meters (6 feet).

## Data Acquisition

Schlieren and on-line computing facilities.

## Testing Capabilities/Current Programs

Has been involved in many test programs around the world and played a part in every major aircraft and weapons development program in which the UK industry has been involved. It has also made significant contributions in transonic aerodynamic research, notably in the field of scale effects.

## Planned Improvements

## User Fees

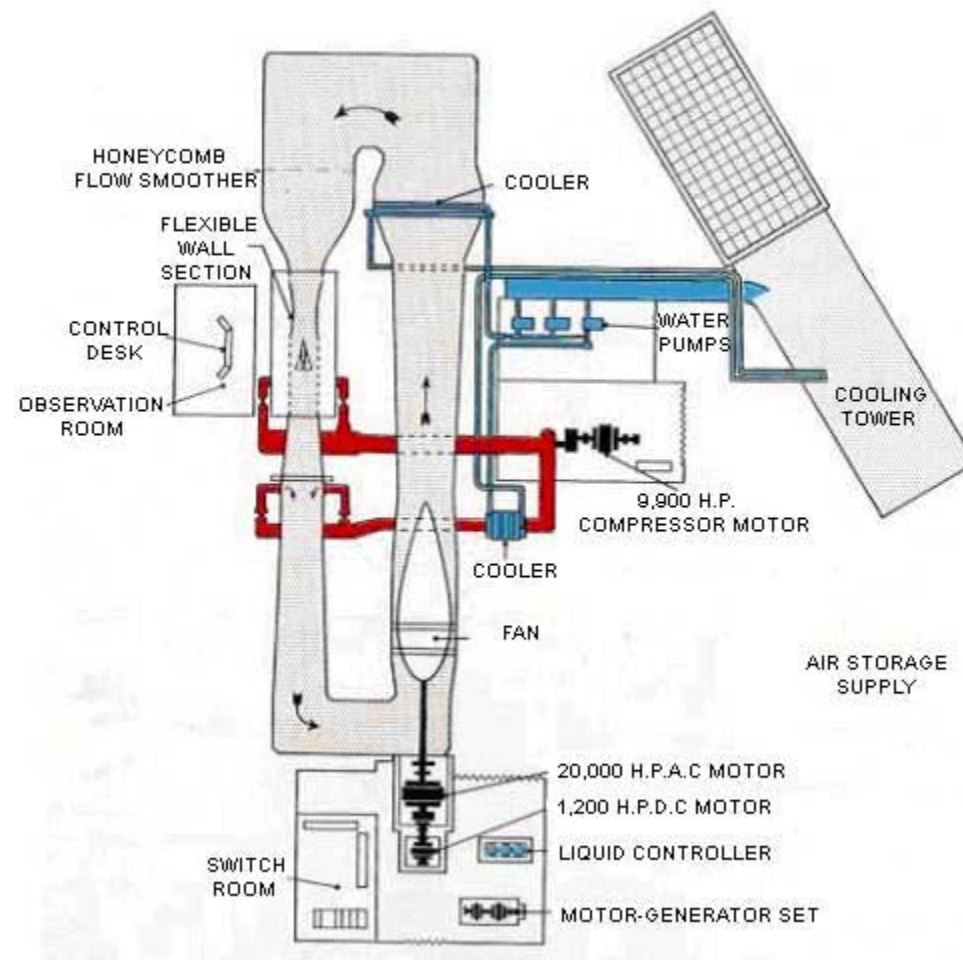
## Contact Information

Aircraft Research Association Ltd, Manton Lane, Bedford, Bedfordshire, MK41 7PF, England.

Tel: (44) 0 1234 350681, Fax: (44) 0 1234 328584, Email: [ara@ara.co.uk](mailto:ara@ara.co.uk), Web site: [http://www.ara.co.uk/transonic\\_wind\\_tunnel.htm](http://www.ara.co.uk/transonic_wind_tunnel.htm).



## European and Asian Wind Tunnels



**Transonic Wind Tunnel (TWT), Aircraft Research Association Limited (ARA), Bedford, England.**

# European and Asian Wind Tunnels

Transonic

England

<b>Installation Name</b>	<b>Test Section Size</b>	<b>Speed Range</b>
Aircraft Research Association Limited (ARA), Bedford, England	0.20 x 0.46 m	102 to 296 m/s
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	Ambient
<b>Facility Name</b>		<b>Reynolds Number (million)</b>
Two-Dimensional (2D) Wind Tunnel	<b>Cost</b>	19
		<b>Dynamic Pressure</b>
	<b>Operational Status</b>	
	Presumed active as of November 2005	<b>Stagnation Pressure</b>
		1.5 to 4.0 bar

## Supplementary Technical Parameters

The 2D wind tunnel is a blowdown tunnel, it has a run time of 20 seconds, -11 to +20° incidence range, roll range n/a and a maximum model length of 0.13 m.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Aircraft Research Association Ltd, Manton Lane, Bedford, Bedfordshire, MK41 7PF, England, UK.  
Tel: (44) 0 1234 350681, Fax: (44) 0 1234 328584, Email: ara@ara.co.uk, Web site: <http://www.ara.co.uk/z4t.htm>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Transonic

France

Installation Name	Test Section Size	Speed Range
ONERA French Aeronautics and Space Research Center, Modane-Avrieux, France	#1: 40 x 42.6 m (slotted walls); #2: 45 x 45 m (solid walls); # 3: 45.4 x 47 m (solid walls); #3: 38.5 x 38.5 (anechoic walls)	#1: up to 1; #2: up to 1; #3 (solid): up to 1; #3 (anechoic walls): up to 0.85 Mach
		Temperature Range
	Date Built/Upgrade	Ambient (-4 to 140°F)
Facility Name	1951	Reynolds Number (million)
S1Ma Continuous Atmospheric Sub/Transonic Wind Tunnel	Cost	#1: 7.3 to 7.5; #2: 7.7; #3 (solid): 7.7 to 7.9; #3 (anechoic): 6.7
		Dynamic Pressure
	Operational Status	
	Presumed active as of September 2005	Stagnation Pressure
		Atmospheric

## Supplementary Technical Parameters

Continuous, high-speed, closed-circuit, atmospheric test facility, 88 MV. Three interchangeable test sections, 26 ft in diameter, 25 ft long. Slotted construction type. Return type circuit. Two counter rotating fans, 88 MW Pelton turbines. Channel to record up to 2000 pressures. External and internal balances. Rectangular closed circuit 155 m long x 40 m wide, maximum diameter of 24 m, test section diameter of 8 m.

## Data Acquisition

DEC VAX 6320, up to 120 channels + 64 channels 20 kHz

## Testing Capabilities/Current Programs

Aero, ground transportation, building, CTS, rotor and propeller test rigs, icing, real engines test types.

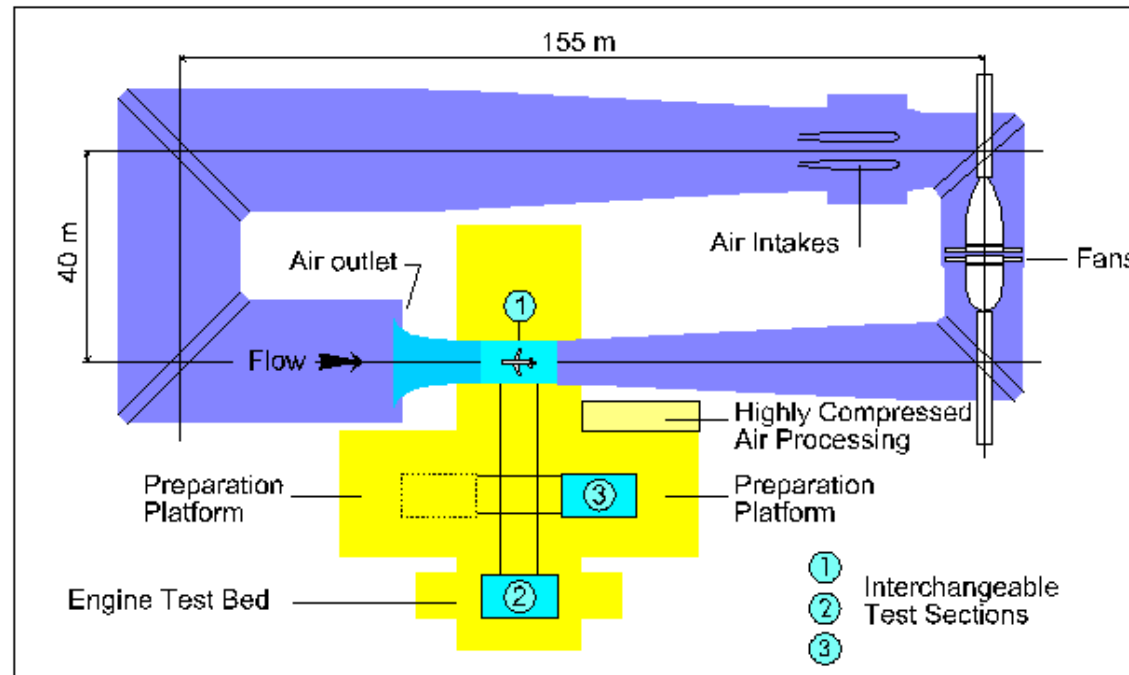
## Planned Improvements

## User Fees

## Contact Information

Jean-Paul Bècle (Director), Modane-Avrieux Wind Tunnel Department, ONERA, PO Box 25, F-73500 Modane, France.  
Tel: (33) 4 79 20 20 91, Fax: (33) 4 79 20 21 68, Email: [becle@onera.fr](mailto:becle@onera.fr), Web site: <http://www.onera.fr/gmt-en/wind-tunnels/s1ma-bis.html>.

## European and Asian Wind Tunnels



**S1Ma Wind Tunnel, ONERA French Aeronautics and Space Research Center, Modane-Avrieux, France.**

# European and Asian Wind Tunnels

Transonic

Germany

<b>Installation Name</b>	<b>Test Section Size</b>	<b>Speed Range</b>
European Transonic Wind Tunnel (ETW), Cologne, Germany	2.0 x 2.4 x 9.0 m	0.15 to 1.35 Mach
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	110 to 313°K
<b>Facility Name</b>		<b>Reynolds Number (million)</b>
2 x 2.4 m Cryogenic Wind Tunnel	<b>Cost</b>	up to 50 (full models), up to 85 (half models)
		<b>Dynamic Pressure</b>
	<b>Operational Status</b>	
	Presumed active as of October 2005	<b>Stagnation Pressure</b>
		1.25 to 4.5 bar

## Supplementary Technical Parameters

Closed aerodynamic circuit wind tunnel, with an insulated stainless steel pressure shell. It has drive power up to 50 MW. A –160° C nitrogen flow is driven through two filling screens into the stilling chamber and through a honeycomb flow straightener and two anti-turbulence screens, with 12:1 contraction ratio.

## Data Acquisition

## Testing Capabilities/Current Programs

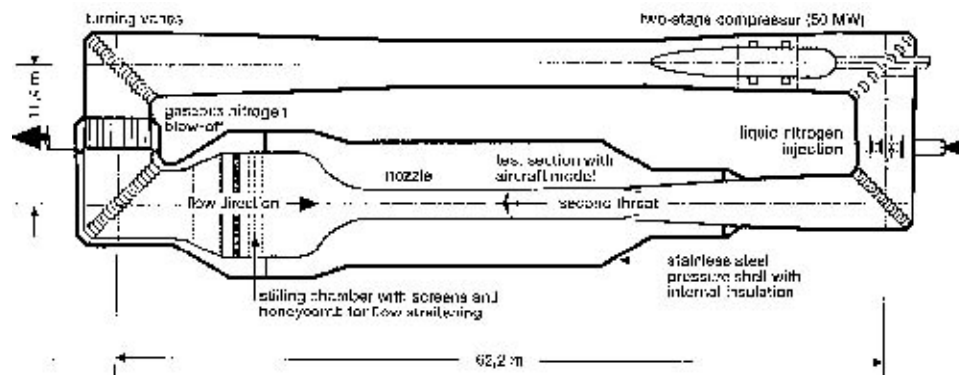
## Planned Improvements

## User Fees

## Contact Information

European Transonic Wind Tunnel, Ernst-Mach-Strasse, D-51147 Köln, Germany.  
Tel/Fax: (49) (0) 2203/609, Email: [manager@etw.de](mailto:manager@etw.de), Web site: <http://www.etw.de/windtunnel/windtunnel.htm>.

## European and Asian Wind Tunnels



**2 x 2.4 m Cryogenic Wind Tunnel, European Transonic Wind Tunnel (ETW), Cologne Germany.**

# European and Asian Wind Tunnels

Transonic

Germany

<b>Installation Name</b>	<b>Test Section Size</b>	<b>Speed Range</b>
German-Dutch Wind Tunnels (DNW), Göttingen, Germany	0.4 x 0.35 m	102 to 323 m/s
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	100 to 300°K
<b>Facility Name</b>	1982/1994 (upgrade)	<b>Reynolds Number (million)</b>
Transonic Wind Tunnel (KRG)	<b>Cost</b>	
		<b>Dynamic Pressure</b>
	<b>Operational Status</b>	<b>Stagnation Pressure</b>
	Presumed active as of September 2005	

## Supplementary Technical Parameters

Intermittent Ludwig tube ( $t = 0.6 \text{ s} - 1.0 \text{ s}$ ).

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

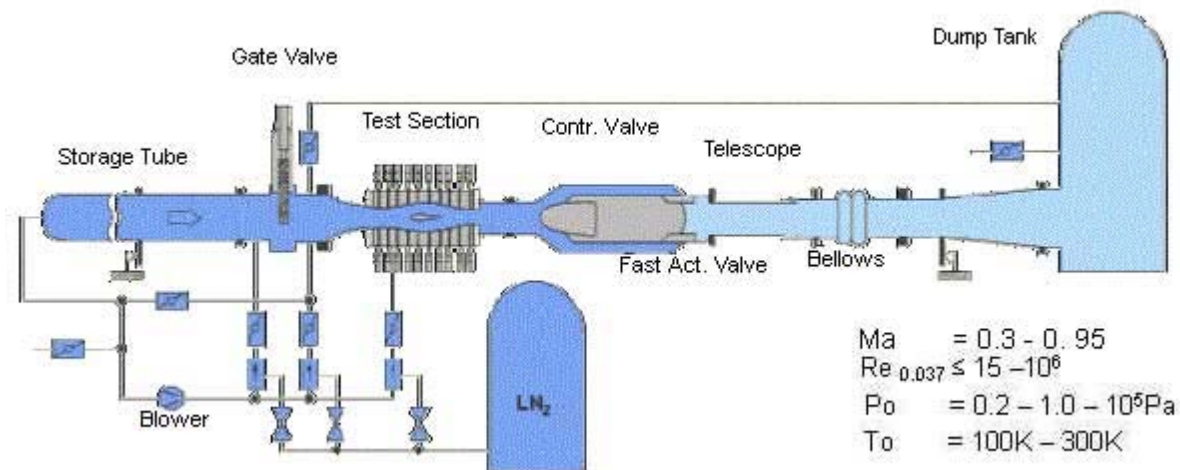
## User Fees

## Contact Information

Dr.-Ing. K.-W. Bock, German-Dutch Wind Tunnels (DNW), Bunsenstrasse 10, 37073 Göttingen, Germany.  
Tel: (49) 551 709 2820, Fax (49) 551 709 2888, Email: dnw-guk@dnw.aero, Web site: <http://www.dnw.aero/>.



## European and Asian Wind Tunnels



**Transonic Wind Tunnel (KRG), German-Dutch Wind Tunnels (DNW), Göttingen, Germany.**

# European and Asian Wind Tunnels

Transonic

Germany

Installation Name	Test Section Size	Speed Range
German-Dutch Wind Tunnels (DNW), Göttingen, Germany	1.0 x 1.0 m	0.3 to 0.9 Mach (adaptive walls); 0.3 - 1.2 (perforated walls); 1.3 - 2.2 Mach (flexible Laval nozzle)
		Temperature Range
	Date Built/Upgrade	293 - 315°K
Facility Name	1991-1993	Reynolds Number (million)
Transonic Wind Tunnel (TWG)	Cost	1.8
		Dynamic Pressure
	Operational Status	
	Presumed active as of October 2005	Stagnation Pressure
		0.3 to 1.5 ???

## Supplementary Technical Parameters

Continuous pressurized wind tunnel. The TWG is a continuously working wind tunnel with three exchangeable test sections for subsonic, transonic, and supersonic speed ranges. The 4 (or 8) stage axial compressor has an electric power supply of 12 MW. An auxiliary suction plant with radial compressors for the transonic test section (perforated walls) is also available.

## Data Acquisition

150,000 lines of code unix operating system.

## Testing Capabilities/Current Programs

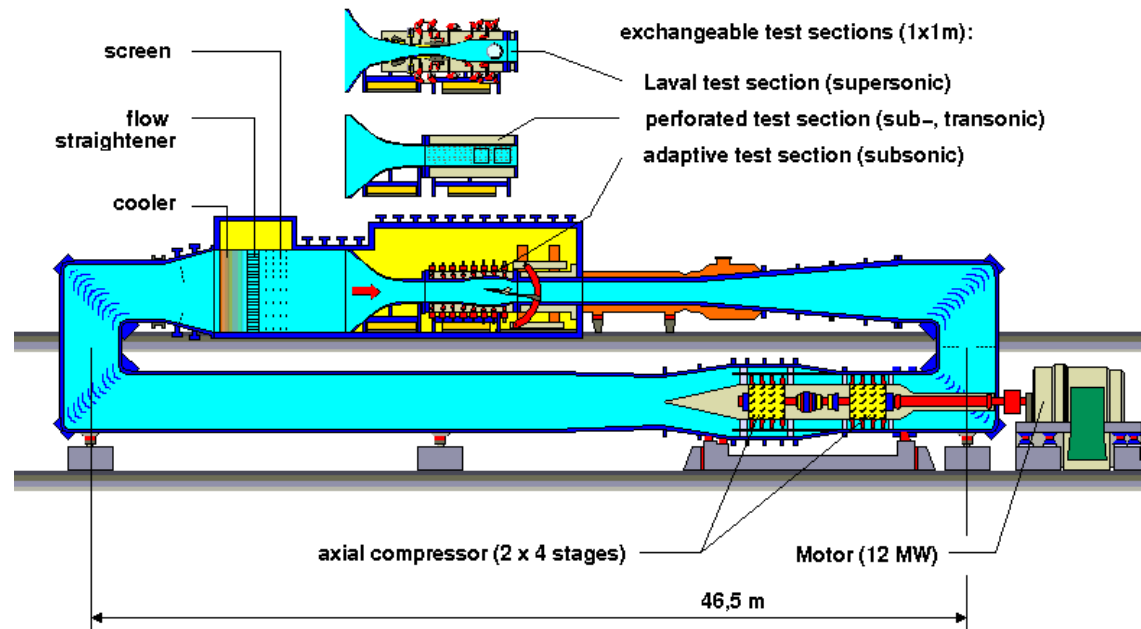
## Planned Improvements

## User Fees

## Contact Information

Dr.-Ing. K.-W. Bock, German-Dutch Wind Tunnels (DNW), Bunsenstrasse 10, 37073 Göttingen, Germany.  
Tel: (49) 551 709 2820, Fax (49) 551 709 2888, Email: dnw-guk@dnw.aero, Web site: <http://www.dnw.aero/>.

## European and Asian Wind Tunnels



**Transonic Wind Tunnel (TWG), German-Dutch Wind Tunnels (DNW), Göttingen, Germany.**

# European and Asian Wind Tunnels

Transonic

Italy

Installation Name	Test Section Size	Speed Range
Italian Aerospace Research Center (CIRA), Capua, Italy	0.35 x 0.45 x 0.6 m	up to .35 Mach (continuous, subsonic), up to 1.1 Mach (intermittent at subsonic and transonic), up to 1.4 Mach (supersonic)
		Temperature Range
	Date Built/Upgrade	
Facility Name		Reynolds Number (million)
PT-1 Transonic Wind Tunnel	Cost	
		Dynamic Pressure
	Operational Status	
	Presumed active as of October 2005	Stagnation Pressure
		1.85 bar (max)

## Supplementary Technical Parameters

The PT-1 is a pressurized wind tunnel facility with a continuous and intermittent flow in subsonic, transonic, and supersonic regimes. 145-kW speed fan. Powered by high pressure air-injection system. Runtime of 150 seconds.

## Data Acquisition

## Testing Capabilities/Current Programs

Aerodynamic and aeroacoustic tests on wing sections, rotor and turbine blades, missiles, launch vehicles at subsonic, transonic and supersonic regimes in support of industry and research.

## Planned Improvements

## User Fees

## Contact Information

Italian Aerospace Research Center (Centro Italiano Ricerche Aerospaziali: CIRA), Via Maiorise, 81043 Capua, Italy.  
Tel: (39) 0823 623001, Email: [info@cira.it](mailto:info@cira.it), Web site: <http://www.cira.it/>.

## European and Asian Wind Tunnels



**PT-1 Transonic Wind Tunnel, Italian Aerospace Research Center (CIRA), Capua, Italy.**

# European and Asian Wind Tunnels

Transonic

Sweden

Installation Name	Test Section Size	Speed Range
Swedish Defense Research Agency, FOI, Stockholm, Sweden	1.5 x 1.5 m	0.2 to 1.25 (slotted walls), 0.2 to 2.0 (solid walls)
		Temperature Range
	Date Built/Upgrade	
Facility Name	1989	Reynolds Number (million)
T1500 Transonic Wind Tunnel	Cost	up to 80
		Dynamic Pressure
	Operational Status	
	Presumed active as of October 2005	Stagnation Pressure

## Supplementary Technical Parameters

Closed-circuit, pressurized. Up to four runs per hour. Tests available in 10 minutes.

## Data Acquisition

Unsteady force measurements, electronic pressure scanning systems, and flow visualization.

## Testing Capabilities/Current Programs

## Planned Improvements

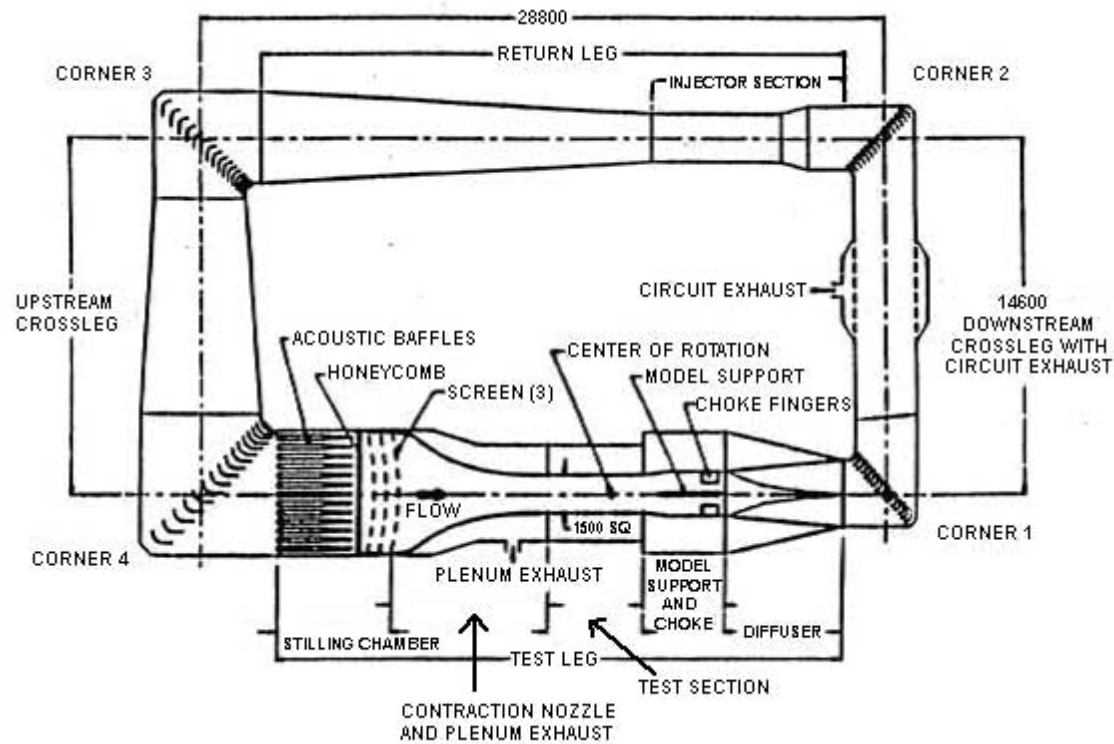
## User Fees

## Contact Information

Bengt Hultqvist (Head), Experimental Aerodynamics, Swedish Defense Research Agency, SE-164 90 Stockholm, Sweden.

Tel (Hultqvist): (46) 8 555 043 39, Tel (Main): (46) 8 555 030 00, Fax: (46) 8 555 031 00, Email (Hultqvist): [bengt.hultqvist@foi.se](mailto:bengt.hultqvist@foi.se), Web site: <http://www.foi.se/>.

## European and Asian Wind Tunnels



**T1500 Transonic Wind Tunnel, Swedish Defense Research Agency (FOI), Stockholm, Sweden.**

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# European and Asian Wind Tunnels

Supersonic

Belgium

Installation Name	Test Section Size	Speed Range
Von Karman Institute for Fluid Dynamics (VKI), Saint Genese, Belgium	Three 40 x 36 cm test sections	15 to 20 Mach
		Temperature Range
	Date Built/Upgrade	
Facility Name		Reynolds Number (million)
S-1 Supersonic Wind Tunnel	Cost	4
		Dynamic Pressure
	Operational Status	
	Presumed active as of November 2005	Stagnation Pressure

## Supplementary Technical Parameters

Continuous, closed circuit. Ackeret type, driven by a 615 kW axial flow compressor. A solid half nozzle  $M=1.43$  for shock wave/boundary layer studies. Three-degree traverse mechanism, variable incidence mechanism up to  $\pm 35$  degrees.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

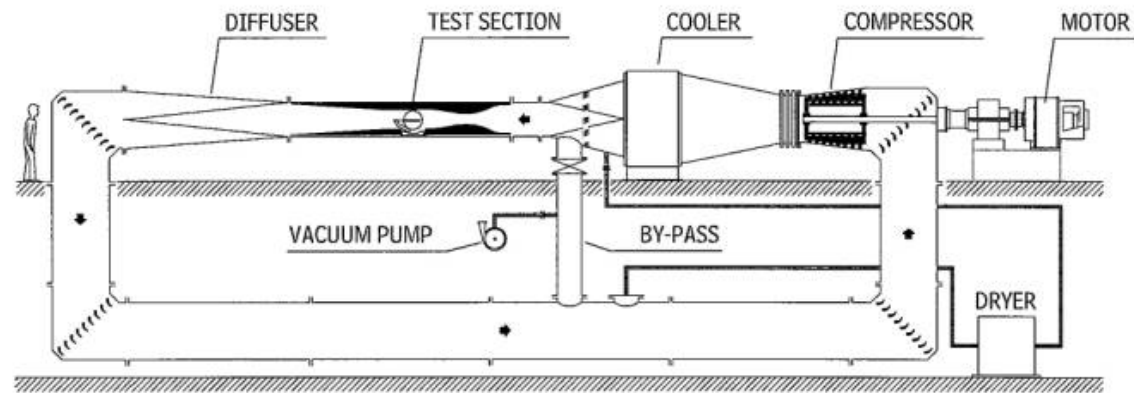
## User Fees

## Contact Information

Olivier Chazot, Von Karman Institute for Fluid Dynamics, B-1640 Rhode, Genese, Belgium.

Tel: (32) 02 359 11, Fax: (32) 02 359 96 00, Email: [chazot@vki.ac.be](mailto:chazot@vki.ac.be), Web site: <http://www.vki.ac.be/ar-dept/virtual/facility/s1/s1.html>.

## European and Asian Wind Tunnels



**S-1 Supersonic Wind Tunnel, Von Karman Institute (VKI), St. Genese, Belgium.**

# European and Asian Wind Tunnels

Supersonic

Belgium

<b>Installation Name</b>	<b>Test Section Size</b>	<b>Speed Range</b>
Von Karman Institute for Fluid Dynamics (VKI), Saint Genese, Belgium	8 x 10 cm	3.5 Mach
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	
<b>Facility Name</b>		<b>Reynolds Number (million)</b>
S-4 Supersonic Wind Tunnel	<b>Cost</b>	50
		<b>Dynamic Pressure</b>
	<b>Operational Status</b>	
	Presumed active as of September 2005	<b>Stagnation Pressure</b>
		3 to 18 bar

## Supplementary Technical Parameters

Blow-down wind tunnel. Test times can be achieved in 8 to 25 minutes, depending on stagnation pressure. Model incidence range from -10 to +10 degrees. The S-4 is also equipped with shadow and schlieren systems.

## Data Acquisition

## Testing Capabilities/Current Programs

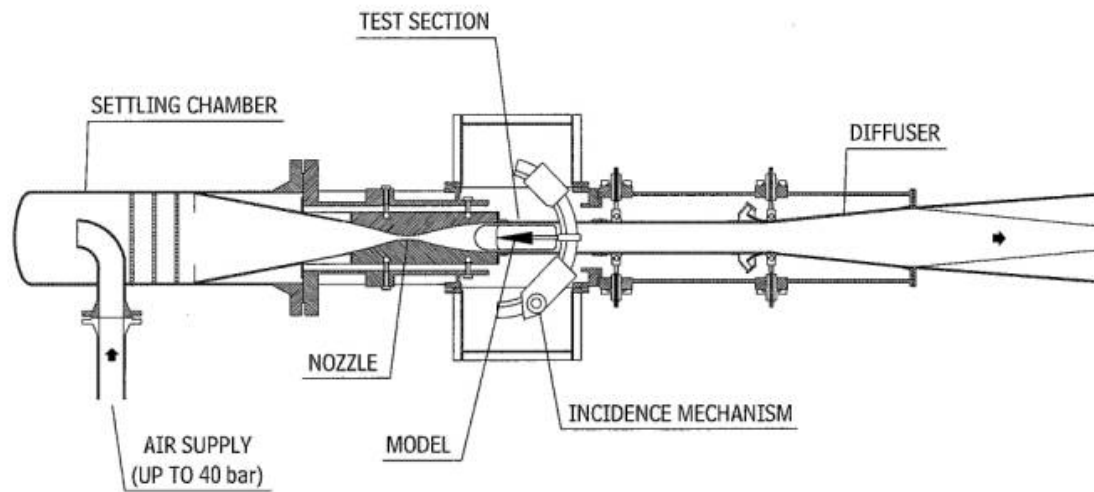
## Planned Improvements

## User Fees

## Contact Information

Olivier Chazot, Von Karman Institute for Fluid Dynamics, B-1640 Rhode, Genese, Belgium.  
Tel: (32) 02 359 96 11, Fax: (32) 02 359 96 00, Email: [chazot@vki.ac.be](mailto:chazot@vki.ac.be), Web site: <http://www.vki.ac.be/ar-dept/virtual/facility/>.

## European and Asian Wind Tunnels



**S-4 Supersonic Wind Tunnel, Von Karman Institute (VKI), St. Genese, Belgium.**

# European and Asian Wind Tunnels

Supersonic

China

Installation Name	Test Section Size	Speed Range
China Academy of Aerospace Aerodynamics (CAAA), Beijing, China AKA: Beijing Institute of Aerodynamics (BIA) or 701st Institute of the China Aerospace Science & Technology Corp (CASC)	0.6 x 0.6 x 1.575 m	0.4 to 4.5 Mach
		Temperature Range
	Date Built/Upgrade	
		Reynolds Number (million)
Facility Name		
Supersonic Wind Tunnel	Cost	
		Dynamic Pressure
	Operational Status	Stagnation Pressure
	Presumed active as of November 2005	

## Supplementary Technical Parameters

Intermittent semi-return.

## Data Acquisition

Central integrated measurement, control, and processing by computers.

## Testing Capabilities/Current Programs

Measurement of pressure and forces on full- and half-scale models, measurement of aircraft roll characteristics, air inlet model tests, jet flow interference tests, inter-stage separation and multi-body interference tests, Magnus effect tests, measurement of hinge moments on full- and half-scale models, tests on the dynamic and unsteady aerodynamic characteristics of aircraft, flutter and buffeting tests, model free flight tests, and flow and vortex visualization.

## Planned Improvements

## User Fees

## Contact Information

Li Feng (Director), China Academy of Aerospace Aerodynamics (CAAA), 17 Yungang West Road, Fengtai District, Beijing 100074, China.  
Tel: (86) 10 68740603, Fax: (86) 10 68374758, Email: caaa@bia701.com, Web site: <http://www.bia701.com>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**



# European and Asian Wind Tunnels

Supersonic

China

Installation Name	Test Section Size	Speed Range
China Academy of Aerospace Aerodynamics (CAAA), Beijing, China AKA: Beijing Institute of Aerodynamics (BIA) or 701st Institute of the China Aerospace Science & Technology Corp (CASC)	0.6 x 0.6 m (perforated wall)	0.4 to 4.5 Mach (using 10 fixed nozzle blocks)
		Temperature Range
	Date Built/Upgrade	
Facility Name	1962	Reynolds Number (million)
BIA Trisonic Wind Tunnel FD-06		12 to 30
	Cost	Dynamic Pressure
	Operational Status	Stagnation Pressure
	Presumed active as of November 2005	up to ~15 atmospheric

## Supplementary Technical Parameters

Semi-blowdown (ejector augmented), AGARD B models used to compare data with western tunnels.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Li Feng (Director), China Academy of Aerospace Aerodynamics (CAAA), 17 Yungang West Road, Fengtai District, Beijing 100074, China.  
Tel: (86) 10 68740603, Fax: (86) 10 68374758, Email: caaa@bia701.com, Web site: <http://www.bia701.com>.

## European and Asian Wind Tunnels

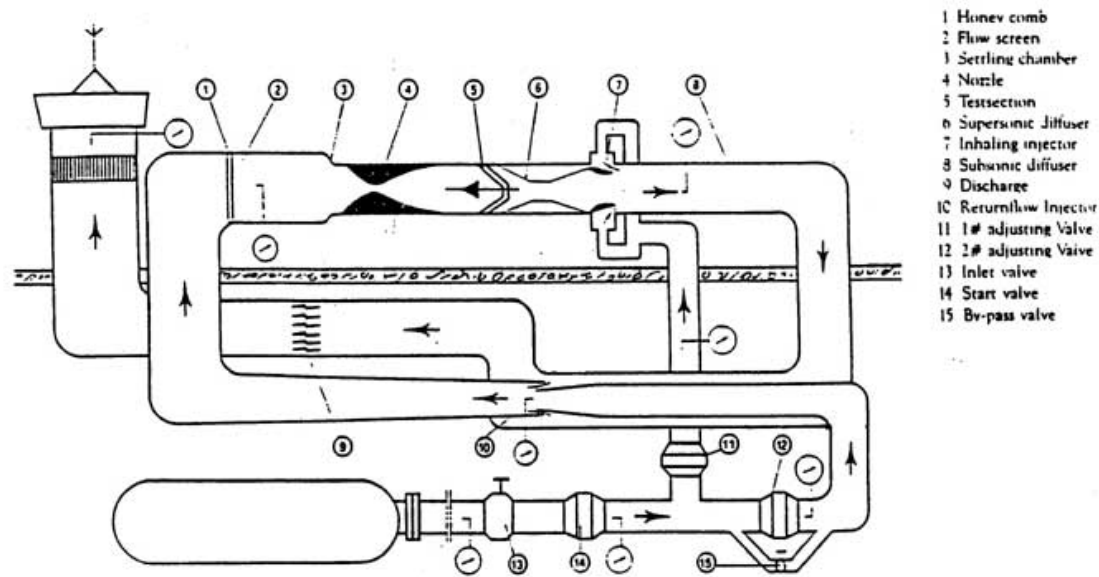


Figure 4.1-2 BIA Trisonic Wind Tunnel FD-06

**BIA Trisonic Wind Tunnel FD-06, China Academy of Aerospace Aerodynamics (CAAA), Beijing, China.**

# European and Asian Wind Tunnels

Supersonic

China

Installation Name	Test Section Size	Speed Range
China Aerodynamics Research and Development Center (CARD C), Mianyang City, Sichuan Province, China	1.2 x 1.2 m	0.6 to 3.5 Mach
		Temperature Range
	Date Built/Upgrade	
Facility Name	1979	Reynolds Number (million)
1.2 x 1.2 m Trisonic Wind Tunnel		35
	Cost	Dynamic Pressure
	Operational Status	Stagnation Pressure
	Presumed active as of November 2005. 3000 runs/year reported.	up to 4.5 atmospheric

## Supplementary Technical Parameters

Run time 45 to 60 seconds. Named transonic by manufacturer.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

Improvements planned to flow quality.

## User Fees

## Contact Information

Shang Shouhong (Dean), China Aerodynamics Research and Development Center Graduate School, PO Box 211, Mianyang City, Sichuan Province 621000, China.  
Tel: (86) 816 246 3053, Fax: (86) 816 246 3051, Email: ssh@cardcgs.com, Web site: <http://www.cardcgs.com/cardcgs/index.asp>,  
<http://www.cardcgs.com/default2.asp>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Supersonic

China

Installation Name	Test Section Size	Speed Range
Chinese Aerodynamics Research Institute of Aeronautics (CARIA), Harbin, Heilongjiang Province, China	0.6 x 0.6 m	0.35 to 4.0 Mach
		Temperature Range
	Date Built/Upgrade	
Facility Name	1960	Reynolds Number (million)
FL-1 Supersonic Wind Tunnel	Cost	
		Dynamic Pressure
	Operational Status	
	Presumed active as of November 2005	Stagnation Pressure

## Supplementary Technical Parameters

When testing at transonic speeds, the upper and lower walls are perforated walls with an open area ratio of 15 percent with pore diameters of ten mm and solid side walls. When testing at supersonic speeds, all four walls are solid walls.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Professor Yu Tao (Director), Chinese Aerodynamic Research Institute of Aeronautics (CARIA), PO Box 88, 2 Yiman Street, Harbin, Heilongjiang, China 150001.  
Tel: (86) 451 82539364, Fax: (86) 451 82838327, Email: cph@caria.com.cn, Web site: <http://www.caria.com.cn>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Supersonic

China

Installation Name	Test Section Size	Speed Range
Chinese Aerodynamics Research Institute of Aeronautics (CARIA), Harbin, Heilongjiang Province, China	1.2 x 1.2 m	0.4 to 2.0 Mach
		Temperature Range
	Date Built/Upgrade	
Facility Name	1993/1995	Reynolds Number (million)
FL-2 Supersonic Wind Tunnel	Cost	Variable
		Dynamic Pressure
	Operational Status	
	Presumed active as of November 2005	Stagnation Pressure

## Supplementary Technical Parameters

Direct-action, intermittent blowdown, trisonic wind tunnel with a variable Reynolds number.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Professor Yu Tao (Director), Chinese Aerodynamic Research Institute of Aeronautics (CARIA), PO Box 88, 2 Yiman Street, Harbin, Heilongjiang Province, 150001 China.

Tel: (86) 451 82539364, Fax: (86) 451 82838327, Email: [cph@caria.com.cn](mailto:cph@caria.com.cn), Web site: <http://www.caria.com.cn>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**



# European and Asian Wind Tunnels

Supersonic

China

Installation Name	Test Section Size	Speed Range
Chinese Aerodynamics Research Institute of Aeronautics (CARIA), Harbin, Heilongjiang Province, China	0.64 x 0.52 m	0.2 to 1.5 Mach (continuously adjustable)
		Temperature Range
	Date Built/Upgrade	
Facility Name	1963	Reynolds Number (million)
FL-7 Supersonic Wind Tunnel	Cost	
		Dynamic Pressure
	Operational Status	
	Presumed active as of November 2005	Stagnation Pressure

## Supplementary Technical Parameters

Test section has four walls with perforated wall panels of variable open area ratio.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Professor Yu Tao (Director), Chinese Aerodynamic Research Institute of Aeronautics (CARIA), PO Box 88, 2 Yiman Street, Harbin, Heilongjiang Province, China 150001.

Tel: (86) 451 82539364, Fax: (86) 451 82838327, Email: cph@caria.com.cn, Web site: <http://www.caria.com.cn>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Supersonic

China

<b>Installation Name</b>	<b>Test Section Size</b>	<b>Speed Range</b>
Key Laboratory of High-Temperature Gas Dynamics (LHD), Beijing, China		2.5 Mach
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	2,100°K
<b>Facility Name</b>	Lab founded in 1994, wind tunnel - unknown	<b>Reynolds Number (million)</b>
Directly Coupled Supersonic Combustion Test Platform	<b>Cost</b>	
		<b>Dynamic Pressure</b>
		1.5 Mpa
	<b>Operational Status</b>	<b>Stagnation Pressure</b>
	Presumed active as of November 2005	

## Supplementary Technical Parameters

Kerosene combustion uses atomized pilot hydrogen and wall cavities. Combustion efficiency is 90 percent and pressure recovery is over 50 percent.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Professor Jiang Zonglin (Director), Key Laboratory of High Temperature Gas Dynamics (LHD), No.15 Beisihuanxi Road, Beijing 100080, China.  
Tel (Lab): (86) 10 62548132, Tel (Director): (86) 10 62545947, Fax (Director): (86) 10 62657081, Email (Director): zljiang@imech.ac.cn, Web site: <http://www.lhd.cn>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Supersonic

China

<b>Installation Name</b>	<b>Test Section Size</b>	<b>Speed Range</b>
Key Laboratory of High-Temperature Gas Dynamics (LHD), Beijing, China	0.8 m (jet tube diameter)	3.5 to 6 Mach
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	
<b>Facility Name</b>	1994	<b>Reynolds Number (million)</b>
Tube/Shock Supersonic Wind Tunnel	<b>Cost</b>	
		<b>Dynamic Pressure</b>
	<b>Operational Status</b>	
	Presumed active as of November 2005	<b>Stagnation Pressure</b>

## Supplementary Technical Parameters

Run time: 30-50 milliseconds.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Professor Jiang Zonglin (Director), Key Laboratory of High Temperature Gas Dynamics (LHD), No.15 Beisihuanxi Road, Beijing 100080, China.  
 Tel (Lab): (86) 10 62548132, Tel (Director): (86) 10 62545947, Fax (Director): (86) 10 62657081, Email (Director): zljiang@imech.ac.cn, Web site:  
<http://www.lhd.cn>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Supersonic

China

Installation Name	Test Section Size	Speed Range
Nanjing University of Aeronautics and Astronautics (NUAA), Nanjing, Jiangsu Province, China	0.6 x 0.6 m	0.3 to 3.0 Mach
		Temperature Range
	Date Built/Upgrade	
Facility Name	1970	Reynolds Number (million)
High Speed Wind Tunnel		
	Cost	Dynamic Pressure
	Operational Status	Stagnation Pressure
	Presumed active as of November 2005	

## Supplementary Technical Parameters

Angle of attack: -30° to +30°. Sideslip angle: -10° to +10°.

## Data Acquisition

## Testing Capabilities/Current Programs

Tests on aircraft, submersibles, engine intake and exhaust gas, and jet flows.

## Planned Improvements

## User Fees

User fees: force measurements, 800 Chinese Yuan (\$100 USD)/hr; pressure measurement 800-1000 Chinese Yuan (\$100-125 USD)/hr; special cases by negotiation.

## Contact Information

Professor Xu Xiwu (Dean), College of Aerospace Engineering, Nanjing University of Aeronautics and Astronautics, 29 Yudao Street, Nanjing, Jiangsu Province, China 210016.

Tel: (86) 25 84891585, Email: xwxu@nuaa.edu.cn, Web site: <http://www.nuaa.edu.cn>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**



# European and Asian Wind Tunnels

Supersonic

China

Installation Name	Test Section Size	Speed Range
Nanjing University of Aeronautics and Astronautics (NUAA), Nanjing, Jiangsu Province, China	0.6 x 0.6 m	0.5 to 3.5 Mach
		Temperature Range
	Date Built/Upgrade	
Facility Name		Reynolds Number (million)
Supersonic Wind Tunnel	Cost	
		Dynamic Pressure
	Operational Status	
	Presumed active as of November 2005	Stagnation Pressure

## Supplementary Technical Parameters

## Data Acquisition

## Testing Capabilities/Current Programs

Tests on aircraft and missiles: six-component force measurements, pressure measurements, hinge moment measurements, flutter and buffeting tests, and acoustic environment tests.

## Planned Improvements

## User Fees

## Contact Information

Professor Xu Xiwu (Dean), College of Aerospace Engineering, Nanjing University of Aeronautics and Astronautics, 29 Yudao Street, Nanjing, Jiangsu Province, China 210016.

Tel: (86) 25 84891585, Email: xwxu@nuaa.edu.cn, Web site: <http://www.nuaa.edu.cn>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Supersonic

China

<b>Installation Name</b>	<b>Test Section Size</b>	<b>Speed Range</b>
Northwestern Polytechnical University (NWPU, NPU), Xi'an, Shaanxi Province, China	0.3 x 0.3 m	0.3 to 4.5 Mach
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	
<b>Facility Name</b>	2002 or 2005	<b>Reynolds Number (million)</b>
Small-Scale High-Speed Research Wind Tunnel	<b>Cost</b>	
		<b>Dynamic Pressure</b>
	<b>Operational Status</b>	<b>Stagnation Pressure</b>
	Presumed active as of November 2005	

## Supplementary Technical Parameters

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Northwestern Polytechnical University, School of Aeronautics, State Key Laboratory for Airfoil and Cascade Aerodynamics, No.127 West Youyi Road, Xi'an City, Shaanxi Province, 710072, China.  
Tel: (86) 29 8492222, Fax: (86) 29 8491000, Web site: <http://www.nwpu.edu.cn>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Supersonic

England

<b>Installation Name</b>	<b>Test Section Size</b>	<b>Speed Range</b>
Aircraft Research Association Limited (ARA), Bedford, England	0.23 x 0.20 m	0.3 to 1.3 Mach
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	Ambient
<b>Facility Name</b>		<b>Reynolds Number (million)</b>
Pilot Wind Tunnel Z4T	<b>Cost</b>	11
		<b>Dynamic Pressure</b>
	<b>Operational Status</b>	
	Pilot	<b>Stagnation Pressure</b>
		Atmospheric

## Supplementary Technical Parameters

Small transonic induction. The Z4T is a small transonic wind tunnel that is 1/12 size of the transonic wind tunnel (TWT). Normal run time is up to 120 seconds, -10 to +18° incidence range, a fixed angle of roll range and maximum model length of 0.20 m.

## Data Acquisition

Schlieren and on-line computing facilities.

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Aircraft Research Association Ltd, Manton Lane, Bedford, Bedfordshire, MK41 7PF, England, UK.  
Tel: (44) 0 1234 350681, Fax: (44) 0 1234 328584, Email: [ara@ara.co.uk](mailto:ara@ara.co.uk), Web site: <http://www.ara.co.uk/z4t.htm>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Supersonic

England

<b>Installation Name</b>	<b>Test Section Size</b>	<b>Speed Range</b>
Aircraft Research Association Limited (ARA), Bedford, England	0.69 x 0.76 m	1.4 to 3.0 Mach
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	Ambient
<b>Facility Name</b>		<b>Reynolds Number (million)</b>
Supersonic Wind Tunnel (SWT)	<b>Cost</b>	8 (Mach 3.0); 20 (Mach 1.4)
		<b>Dynamic Pressure</b>
	<b>Operational Status</b>	
	Presumed active as of November 2005	<b>Stagnation Pressure</b>
		0.4 to 1.4 bar

## Supplementary Technical Parameters

The SWT wind tunnel has a continuous run time, -10 to +40° incidence range, maximum model length of 3.50 meters (11.48 feet).

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Aircraft Research Association Ltd, Manton Lane, Bedford, Bedfordshire, MK41 7PF, England, UK.  
Tel: (44) 0 1234 350681, Fax: (44) 0 1234 328584, Email: [ara@ara.co.uk](mailto:ara@ara.co.uk), Web site: <http://www.ara.co.uk/z4t.htm>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**



# European and Asian Wind Tunnels

Supersonic

England

Installation Name	Test Section Size	Speed Range
Flow Science Limited, Goldstein Research Laboratory, Manchester, England	0.21 x 0.15 x 0.6 m (rectangular cross section w/slotted walls, transonic); 0.21 x 0.15. 0.8 m (rectangular cross section w/slotted wall)	0.3 to 2.0 Mach
		Temperature Range
	Date Built/Upgrade	
Facility Name		Reynolds Number (million)
0.21 x 0.15 m Transonic/Supersonic Wind Tunnel	Cost	
		Dynamic Pressure
	Operational Status	
	Presumed active as of December 2005	Stagnation Pressure

## Supplementary Technical Parameters

Blowdown into reservoir of 130 m<sup>3</sup>, pressurised, intermittent flow, approximate run time 45 seconds, reservoir evacuation < 5 minutes, supersonic Mach 2.0 liners, upstream drier, quick operating valve.

## Data Acquisition

Mach-Zehnder interferometer, schlieren systems, scanivalves, pressure transducers, digital oscilloscopes, digital spectrum analyser for recording transient, unsteady or fluctating flows.

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

David Smith (Operations Director), Flow Science Limited, Goldstein Research Laboratory, Barton Airport Eccles, Manchester M 30 7 RU England.  
Tel/Fax: (44) 0161 787 8749, Email (Director): david@fs1.ae.man.ac.uk, Email (General): Flowsci@fs1.ae.man.ac.uk, Web site:  
<http://www.flow-science.eng.man.ac.uk/etdetail.htm>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Supersonic

France

<b>Installation Name</b>	<b>Test Section Size</b>	<b>Speed Range</b>
French-German Research Institute of Saint Louis (ISL), Saint Louis, France	30 x 30 cm	1.5 to 4.4 Mach
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	320°K
<b>Facility Name</b>		<b>Reynolds Number (million)</b>
Supersonic Wind Tunnel S30	<b>Cost</b>	1.4
		<b>Dynamic Pressure</b>
	<b>Operational Status</b>	
	Presumed active as of September 2005	<b>Stagnation Pressure</b>
		0.2 to 1 Mpa

## Supplementary Technical Parameters

Continuous four-stage 7-MW radial compressor.

## Data Acquisition

Shadow or schlieren photography, measurement of steady and transient pressures, force and moment measurements using wind tunnel balance, laser Doppler velocimetry, particle image velocimetry, Doppler picture technique, and visualization by means of holographic filters.

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

French-German Research Institute of Saint-Louis (ISL), 5 rue du Général Cassagnou, 68300 Saint-Louis, France.

Mailing address: ISL, PO Box 70034, FR 68301 Saint Louis CEDEX.

Tel: (33) 3 89 69 50 00, (33) 3 89 69 50 02, Email: isl@isl.tm.fr, Web site: [http://www.isl.tm.fr/en/generalite/intro\\_pres\\_e.html](http://www.isl.tm.fr/en/generalite/intro_pres_e.html).

## European and Asian Wind Tunnels



**Supersonic Wind Tunnel S30, French-German Research Institute of Saint Louis (ISL), Saint Louis, France.**

# European and Asian Wind Tunnels

Supersonic

France

<b>Installation Name</b>	<b>Test Section Size</b>	<b>Speed Range</b>
ONERA French Aeronautics and Space Research Center, Fluid Mechanics and Energetics Branch, Meudon Center, Meudon, France	0.06 m	3 or 5 Mach
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	up to 400°K (variable stagnation temperature)
<b>Facility Name</b>		<b>Reynolds Number (million)</b>
R1Ch Supersonic Wind Tunnel	<b>Cost</b>	10 to 30
		<b>Dynamic Pressure</b>
	<b>Operational Status</b>	
	Presumed active as of September 2005	<b>Stagnation Pressure</b>
		variable up to 15 bar

## Supplementary Technical Parameters

Long blowdowns from 10 to 60 seconds. Free test section that can be equipped with Mach 3 or Mach 5 nozzles with exit diameter of 0.326 m. Maximum mass flow rate of 80 kg/s.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

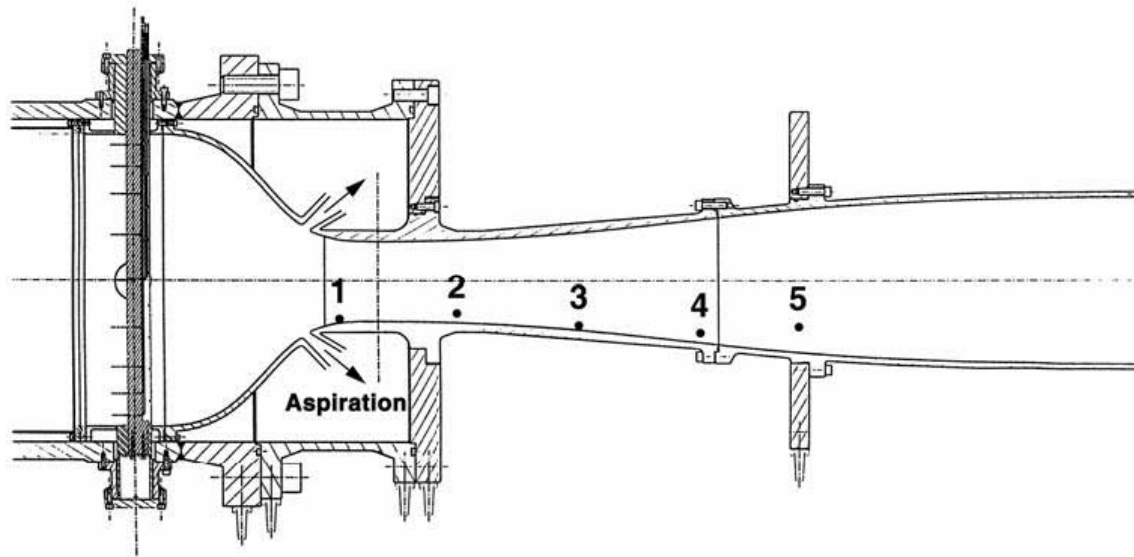
Silent Mach 3 version being developed.

## User Fees

## Contact Information

Bruno Chanetz, Lucien Morzenski, Meudon Center, ONERA – DAFE 8, rue des Vertugadins 92190 Meudon, France.  
Tel (Chanetz): (33) 1 46 23 51 76, Tel (Morzenski): (33) 1 46 23 51 46, Fax: (33) 1 46 23 51 58, Email (Chanetz): chanetz@onera.fr, Email (Morzenski): morzenski@onera.fr, Web site: <http://www.onera.fr/>.

## European and Asian Wind Tunnels



*Figure 5 : Sketch of the R1Ch wind tunnel. 1,2,3,4,5 denote the hot film locations.  
Diameter of the nozzle exit: 30 cm.*

**R1Ch Supersonic Wind Tunnel, ONERA French Aeronautics and Space Research Center, Fluid Mechanics and Energetics Branch, Meudon Center, Meudon, France.**

# European and Asian Wind Tunnels

Supersonic

France

<b>Installation Name</b>	<b>Test Section Size</b>	<b>Speed Range</b>
ONERA French Aeronautics and Space Research Center, Modane-Avrieux, France	1.75 x 1.77 m (transonic), 1.75 x 1.93 m (supersonic)	up to 1.3 Mach (transonic); 1.5 to 3.1 Mach (supersonic)
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	313°K
<b>Facility Name</b>		<b>Reynolds Number (million)</b>
S2Ma Continuous Pressurized Sub/Trans/Supersonic Wind Tunnel	<b>Cost</b>	5.4 (transonic); 4.0 (supersonic)
		<b>Dynamic Pressure</b>
	<b>Operational Status</b>	
	Presumed active as of September 2005	<b>Stagnation Pressure</b>
		2.5 bar

## Supplementary Technical Parameters

Variable pressure, closed circuit, continuous-flow wind tunnel. Sting holder: angle of attack range = 25°, roll range = 360°. Variable knuckle from - 10° to + 25°. Three degree of freedom bent sting: angle of attack range = 46°, yaw range = 22° (with zero roll angle, with continuous variation of incidence (or yaw), yaw (or incidence) being constant. Wall turret: angle of attack range = 360°. Captive trajectory system.

## Data Acquisition

160 analogous channels, 14 bits sign A/D convert; 64 channels, at 20 KHz per channel by SAR system and 56 channels, at 17.7 KHz by PCM systems. Real-time data processing, model supports and tunnel wall interferences

## Testing Capabilities/Current Programs

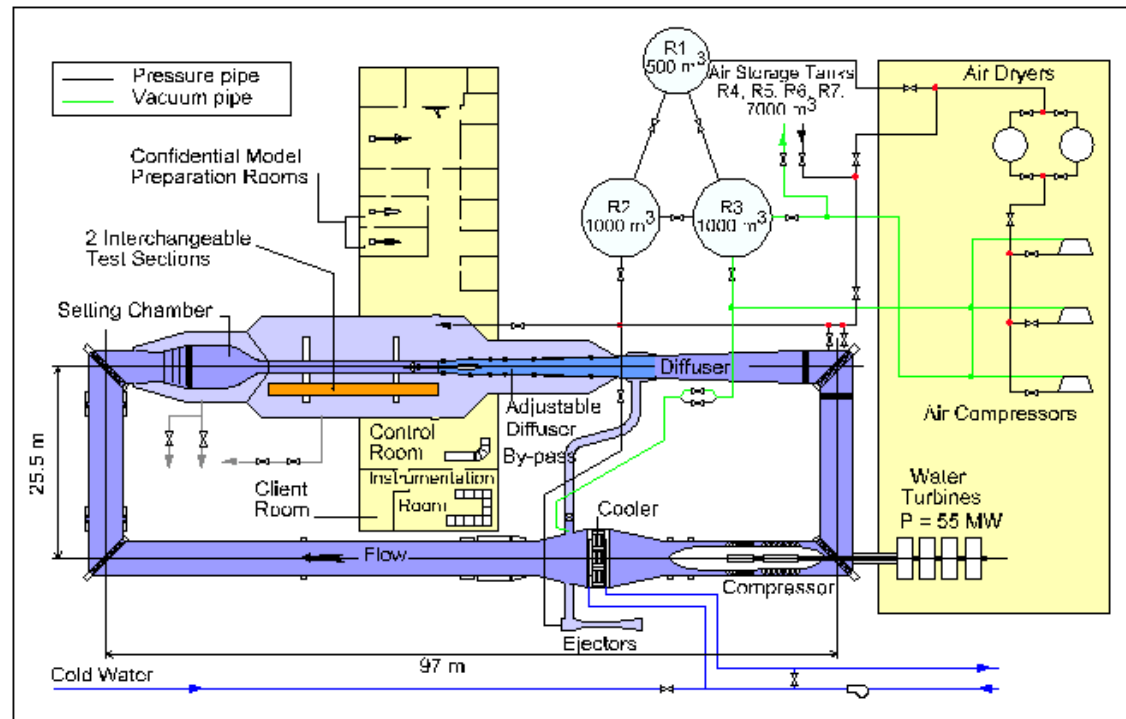
## Planned Improvements

## User Fees

## Contact Information

Jean-Paul Bècle (Director), Modane-Avrieux Wind Tunnel Department, PO Box 25, F-73500 Modane, France.  
Tel: (33) 4 79 20 20 91, Fax: (33) 4 79 20 21 68, Email: becle@onera.fr, Web site: <http://www.onera.fr/gmt-en/wind-tunnels/s2ma-bis.html>.

# European and Asian Wind Tunnels



**S2Ma Wind Tunnel, ONERA French Aeronautics and Space Research Center, Modane-Avrieux, France.**



# European and Asian Wind Tunnels

Supersonic

France

<b>Installation Name</b>	<b>Test Section Size</b>	<b>Speed Range</b>
ONERA French Aeronautics and Space Research Center, Modane-Avrieux, France	0.56 x 0.78 m (transonic), 0.76 x 0.80 m (supersonic)	0.1 to 1.3 Mach (transonic), 1.65 to 5.5 Mach (supersonic)
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	530°K (max)
<b>Facility Name</b>		<b>Reynolds Number (million)</b>
S3Ma Blow-down Pressurized Sub/Trans/Supersonic Wind Tunnel	<b>Cost</b>	3.5 (transonic); 3.2 (supersonic)
		<b>Dynamic Pressure</b>
	<b>Operational Status</b>	
	Active (3 to 20 runs per/day)	<b>Stagnation Pressure</b>
		.02 to 7.5 bar

## Supplementary Technical Parameters

Blow down wind tunnel. Rectangular test section.

## Data Acquisition

48 analog channels: steady measurements rate up to 25 Hz per channel with a 14 bits + sign A/D converter

## Testing Capabilities/Current Programs

## Planned Improvements

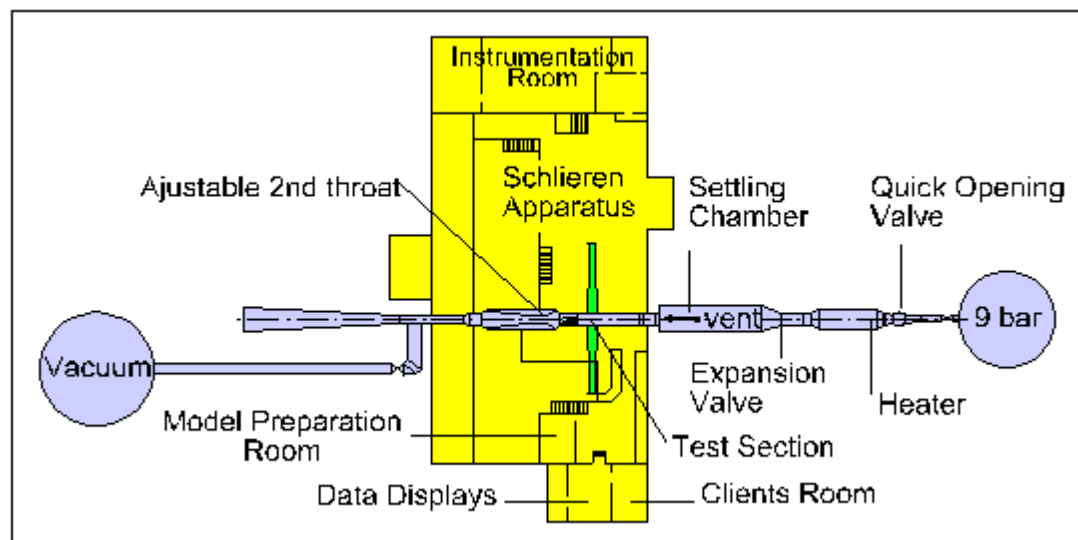
## User Fees

## Contact Information

Jean-Paul Bècle (Director), Modane-Avrieux Wind Tunnel Department, PO Box 25, F-73500 Modane, France.

Tel: (33) 4 79 20 20 91, Fax: (33) 4 79 20 21 68, Email: [becle@onera.fr](mailto:becle@onera.fr), Web site: <http://www.onera.fr/gmt-en/wind-tunnels/s2ma-bis.html>.

## European and Asian Wind Tunnels



**S3Ma Wind Tunnel, ONERA French Aeronautics and Space Research Center, Modane-Avrieux, France.**

# European and Asian Wind Tunnels

Supersonic

Japan

Installation Name	Test Section Size	Speed Range
Japan Aerospace Exploration Agency (JAXA), Institute of Aerospace Technology (IAT), Aerospace Research Center (ARC), Wind Tunnel Technology Center (WINTec), Tokyo, Japan	0.2 x 0.2 m	1.5 to 2.5 Mach
		Temperature Range
	Date Built/Upgrade	330°K
Facility Name	1994/1999 (upgrade)	Reynolds Number (million)
0.2 x 0.2 m Supersonic Wind Tunnel	Cost	
		Dynamic Pressure
		50 to 120 kPa
	Operational Status	Stagnation Pressure
	Presumed active as of December 2005	

## Supplementary Technical Parameters

Continuous circulation type. The settling chamber was repaired in 1999 to improve the quality of the air flow in the test section.

## Data Acquisition

## Testing Capabilities/Current Programs

Research on aerodynamics in a supersonic low-turbulence environment.

## Planned Improvements

## User Fees

## Contact Information

Dr. Masashi Shigemi (WINTec Director), Japan Aerospace Exploration Agency (JAXA), Institute of Aerospace Technology (IAT), Aerospace Research Center (ARC), Wind Tunnel Technology Center (WINTec), 7-44-1 Jindaiji Higashi-machi, Chofu-shi, Tokyo 182-8522, Japan.  
Tel: (81) 3 422 40 3000, Fax: (81) 3 422 40 3281, Email (Director): shigemi.masashi@jaxa.jp, Email (WINTec): wintec@chofu.jaxa.jp, Web site: <http://www.iat.jaxa.jp/res/wttc/b04.html>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Supersonic

Japan

Installation Name	Test Section Size	Speed Range
Japan Aerospace Exploration Agency (JAXA), Institute of Aerospace Technology (IAT), Aerospace Research Center (ARC), Wind Tunnel Technology Center (WINTec), Tokyo, Japan	0.8 x 0.45 m	0.2 to 1.4 Mach
		Temperature Range
	Date Built/Upgrade	
	1979/1997 (upgrade)	Reynolds Number (million)
Facility Name 0.8 x 0.45 m High Reynolds Number Transonic Wind Tunnel	Cost	5 to 40
		Dynamic Pressure
	Operational Status	
	Presumed active as of December 2005	Stagnation Pressure
		196 to 1176 kPa

## Supplementary Technical Parameters

Intermittent blowdown type. Test duration: 9 – 100 seconds

## Data Acquisition

## Testing Capabilities/Current Programs

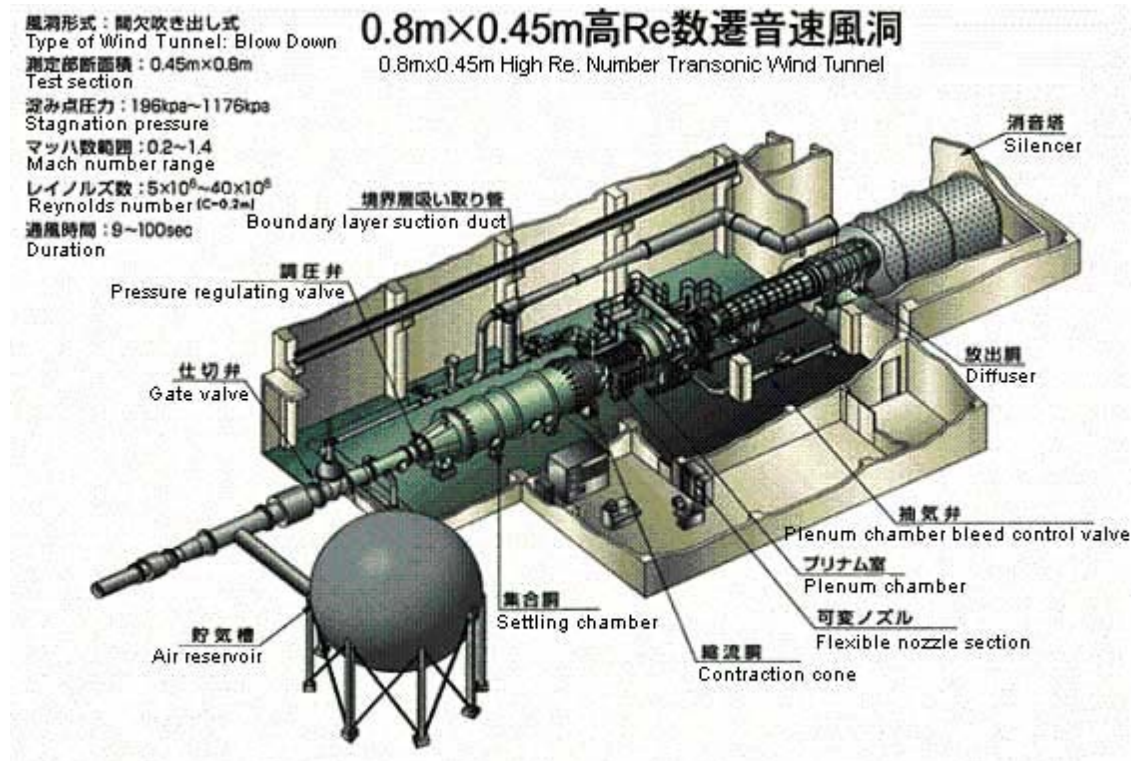
## Planned Improvements

## User Fees

## Contact Information

Dr. Masashi Shigemi (WINTec Director), Japan Aerospace Exploration Agency (JAXA), Institute of Aerospace Technology (IAT), Aerospace Research Center (ARC), Wind Tunnel Technology Center (WINTec), 7-44-1 Jindaiji Higashi-machi, Chofu-shi, Tokyo 182-8522, Japan.  
Tel: (81) 3 422 40 3000, Fax: (81) 3 422 40 3281, Email (Director): shigemi.masashi@jaxa.jp, Email (WINTec): wintec@chofu.jaxa.jp, Web site: <http://www.iat.jaxa.jp/res/wttc/b04.html>.

## European and Asian Wind Tunnels



0.8m×0.45m 高レイノルズ数遷音速風洞全体図

**0.8 x 0.45 m High Reynolds Number Transonic Wind Tunnel, Exploration Agency (JAXA), Institute of Aerospace Technology (IAT), Aerospace Research Center (ARC), Wind Tunnel Technology Center (WINTeC), Tokyo, Japan.**

# European and Asian Wind Tunnels

Supersonic

Japan

Installation Name	Test Section Size	Speed Range
Japan Aerospace Exploration Agency (JAXA), Institute of Aerospace Technology (IAT), Aerospace Research Center (ARC), Wind Tunnel Technology Center (WINTec), Tokyo, Japan	1 x 1 m	1.4 to 4.0 Mach
		Temperature Range
	Date Built/Upgrade	
Facility Name	1961/1999 (upgrade)	Reynolds Number (million)
1 x 1 m Supersonic Wind Tunnel	Cost	20 (Mach 1.4); up to 60 (Mach 4)
		Dynamic Pressure
	Operational Status	
	Presumed active as of December 2005	Stagnation Pressure
		150 kPa (Mach 1.4) to 1,400 kPa (Mach 4.0)

## Supplementary Technical Parameters

Intermittent blowdown type wind tunnel. Run time 40 seconds. Electric powered multi-jack type, two dimensional flexible nozzle. Flow rate 280 kg/sec.

## Data Acquisition

## Testing Capabilities/Current Programs

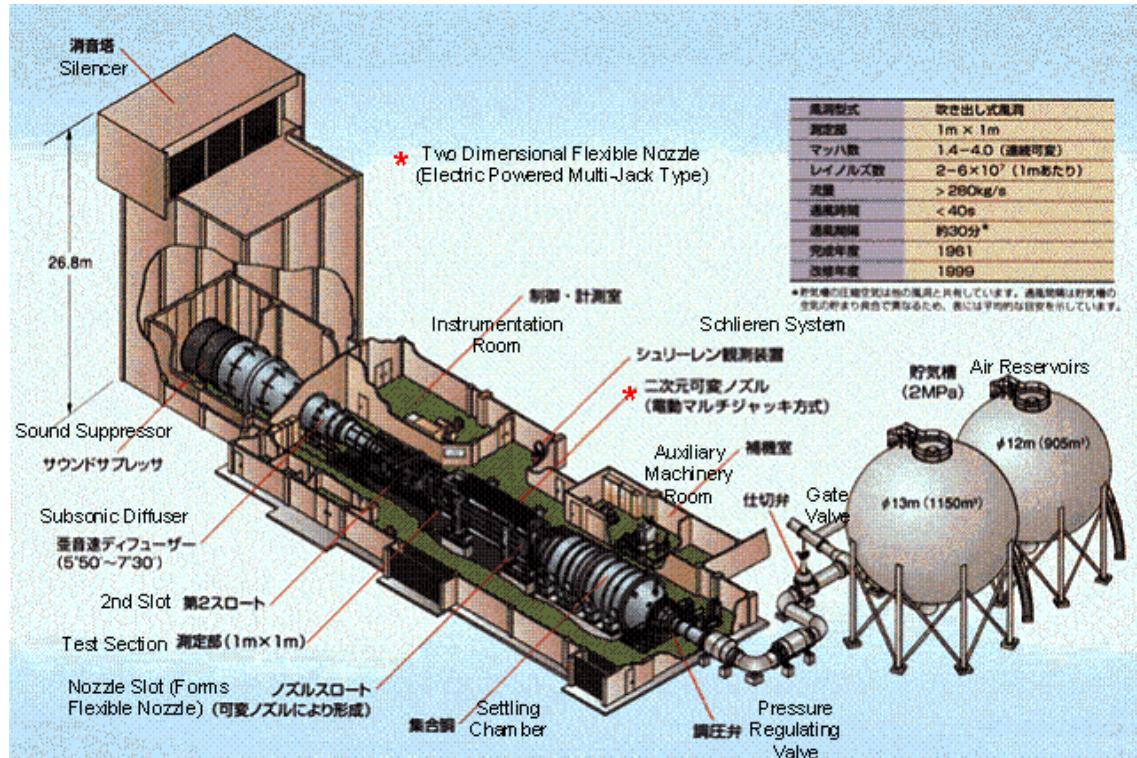
## Planned Improvements

## User Fees

## Contact Information

Dr. Masashi Shigemi (WINTec Director), Japan Aerospace Exploration Agency (JAXA), Institute of Aerospace Technology (IAT), Aerospace Research Center (ARC), Wind Tunnel Technology Center (WINTec), 7-44-1 Jindaiji Higashi-machi, Chofu-shi, Tokyo 182-8522, Japan.  
Tel: (81) 3 422 40 3000, Fax: (81) 3 422 40 3281, Email (Director): shigemi.masashi@jaxa.jp, Email (WINTec): wintec@chofu.jaxa.jp, Web site: <http://www.iat.jaxa.jp/res/wttc/b04.html>.

## European and Asian Wind Tunnels



1m × 1m 超音速風洞全体図

**1 x 1 m Supersonic Wind Tunnel, Japan Aerospace Exploration Agency (JAXA), Institute of Aerospace Technology (IAT), Aerospace Research Center (ARC), Wind Tunnel Technology Center (WINTeC), Tokyo, Japan.**



# European and Asian Wind Tunnels

Supersonic

Japan

Installation Name	Test Section Size	Speed Range
Japan Defense Agency (JDA), Technical Research and Development Institute (TRDI), Tachikawa, Japan		0 to 4 Mach
		Temperature Range
	Date Built/Upgrade	248 to 928°K
Facility Name	1992	Reynolds Number (million)
Combustion Wind Tunnel	Cost	
		Dynamic Pressure
		0.01 to 3.8 Mpa
	Operational Status	Stagnation Pressure
	Presumed active as of December 2005	

## Supplementary Technical Parameters

Air flow rate: 150 kg/sec. Pitch angle and yaw angle in the semi-free jet configuration: 0° ~ +15°, -5° ~ +5°, respectively. Simulation of flight conditions at 0 – 80,000 ft.; testing of ramjet engines in direct-connect (DC) or semi-free jet (SFJ) configurations; testing of solid fuel propellants consecutively in the booster phase, the transient separation phase, and the subsequent ramjet phase.

## Data Acquisition

## Testing Capabilities/Current Programs

Ramjet engine flight conditions and engine performance.

## Planned Improvements

## User Fees

## Contact Information

Japan Defense Agency (JDA), Technical Research and Development Institute (TRDI), 3rd Research Center, 1st Division, 1-2-10, Sakae-cho, Tachikawa-shi, Tokyo, 190-8533, Japan. Wind tunnel located at: Aerodynamic and Propulsion Test Facility of the Sapporo Test Center, 1032, Komasato, Chitose-shi, Hokkaido, 066-0011, Japan. Tel: (81) 123 42 3501.

Tel.: (81) 425 24 2411, Email: [info@jda-trdi.go.jp](mailto:info@jda-trdi.go.jp), Web site: <http://www.jda-trdi.go.jp/happyou.htm>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Supersonic

Japan

<b>Installation Name</b>	<b>Test Section Size</b>	<b>Speed Range</b>
Japan Defense Agency (JDA), Technical Research and Development Institute (TRDI), Tachikawa, Japan	4.3 m (diameter), 12 m (long)	0 to 2.5
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	-72 to +270°C
<b>Facility Name</b>	2002	<b>Reynolds Number (million)</b>
High Altitude Engine Test Facility (ATF)	<b>Cost</b>	
		<b>Dynamic Pressure</b>
		3.5 to 101.3 kPa
	<b>Operational Status</b>	<b>Stagnation Pressure</b>
	Presumed active as of December 2005	

## Supplementary Technical Parameters

Largest facility of its kind in Japan. Air flow: 0 – 70 kg/sec. Engine intake pressure: 7.5 – 244 kPa. Intermediate pressure air source: two IHI LM 1600 centrifugal air compressor gas turbines with a pressure of 686 kPa and a flow rate of 35 kg/sec. Test section can mount engines up to 1.5 tons.

## Data Acquisition

## Testing Capabilities/Current Programs

Jet engine high altitude performance up to 75,000 ft.

## Planned Improvements

## User Fees

## Contact Information

Japan Defense Agency (JDA), Technical Research and Development Institute (TRDI), 3rd Research Center, 1st Division, 1-2-10, Sakae-cho, Tachikawa-shi, Tokyo, 190-8533, Japan. Wind tunnel located at: Aerodynamic and Propulsion Test Facility of the Sapporo Test Center, 1032, Komasato, Chitose-shi, Hokkaido, 066-0011, Japan. Tel: (81) 123 42 3501.

Tel.: (81) 425 24 2411, Email: [info@jda-trdi.go.jp](mailto:info@jda-trdi.go.jp), Web site: <http://www.jda-trdi.go.jp/happyou.htm>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Supersonic

Japan

Installation Name	Test Section Size	Speed Range
Japan Defense Agency (JDA), Technical Research and Development Institute (TRDI), Tachikawa, Japan	2 x 2 m	0.3 to 4.0 Mach
		Temperature Range
	Date Built/Upgrade	
Facility Name	1995	Reynolds Number (million)
Trisonic Wind Tunnel	Cost	100 and up
		Dynamic Pressure
	Operational Status	
	Presumed active as of December 2005	Stagnation Pressure

## Supplementary Technical Parameters

Type: intermittent blow-down. Measuring time: 10 seconds or more. Interval between tests: within 45 minutes. Noise level: 65 Db and below.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

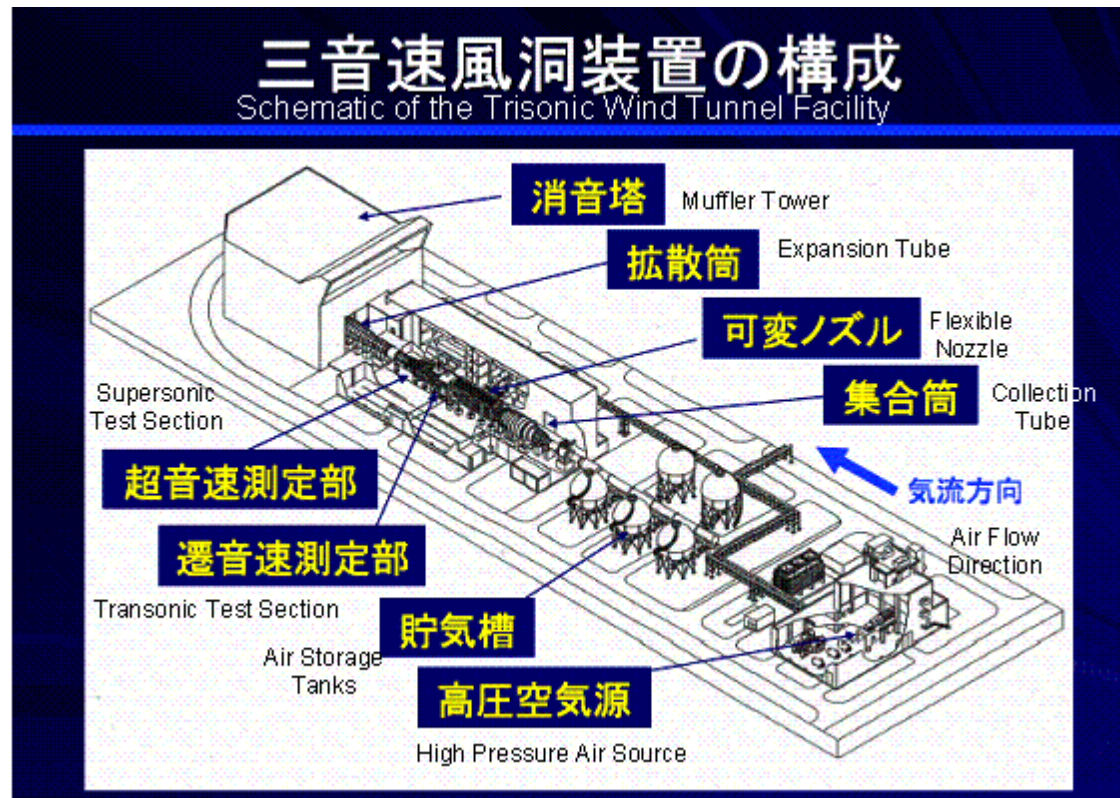
## User Fees

## Contact Information

Japan Defense Agency (JDA), Technical Research and Development Institute (TRDI), 3rd Research Center, 1st Division, 1-2-10, Sakae-cho, Tachikawa-shi, Tokyo, 190-8533, Japan. Wind tunnel located at: Aerodynamic and Propulsion Test Facility of the Sapporo Test Center, 1032, Komasato, Chitose-shi, Hokkaido, 066-0011, Japan. Tel: (81) 123 42 3501.

Tel.: (81) 425 24 2411, Email: [info@jda-trdi.go.jp](mailto:info@jda-trdi.go.jp), Web site: <http://www.jda-trdi.go.jp/happyou.htm>.

## European and Asian Wind Tunnels



**Trisonic Wind Tunnel, Japan Defense Agency (JDA), Technical Research and Development Institute (TRDI), Tachikawa, Japan. Located at the Aerodynamic and Propulsion Test Facility, Sapporo Test Center Hokkaido, Japan.**

# European and Asian Wind Tunnels

Supersonic

Japan

Installation Name	Test Section Size	Speed Range
Mitsubishi Heavy Industries Kobe Shipyard and Machinery Works (MHI Kobe), Kobe, Japan	600 mm (nozzle exit diameter)	0.4 to 4.0 Mach
		Temperature Range
	Date Built/Upgrade	Room temperature
Facility Name		Reynolds Number (million)
60 cm Trisonic Wind Tunnel		2
	Cost	Dynamic Pressure
		1.18 Mpa (max)
	Operational Status	Stagnation Pressure
	Presumed active as of December 2005	

## Supplementary Technical Parameters

This wind tunnel covers subsonic, transonic, and supersonic regimes; it has been named trisonic by the manufacturer. Intermittent blow out. Nozzle outlet: 0.6 x 0.6 m. Blowing time: 20 seconds at Mach 1.0, 35 seconds at Mach 2.5. Air source: spherical air tank with an inside diameter of 8 meters.

## Data Acquisition

## Testing Capabilities/Current Programs

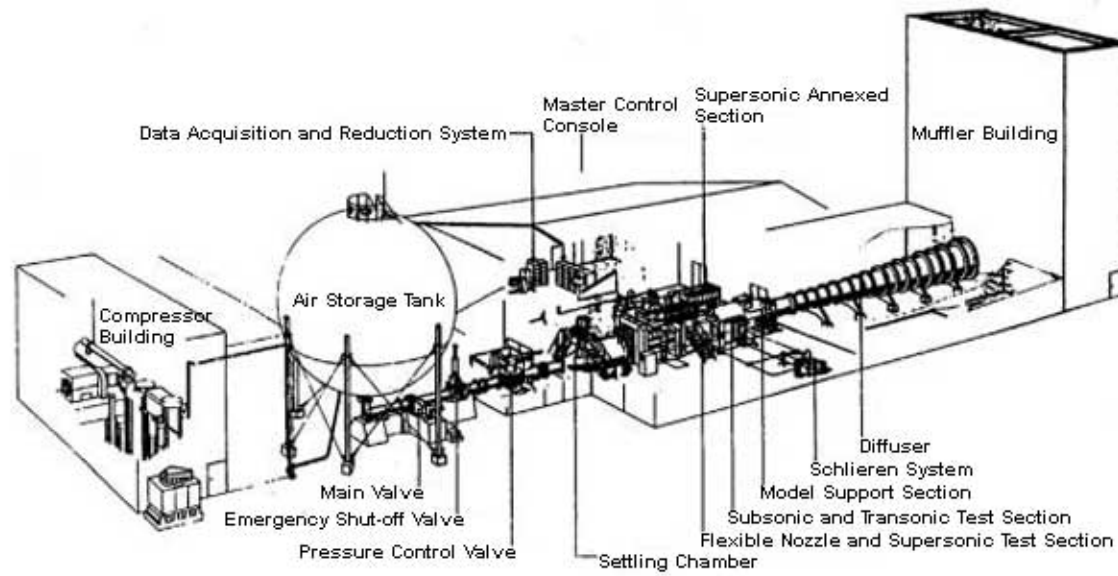
## Planned Improvements

## User Fees

## Contact Information

Mitsubishi Heavy Industries Kobe Shipyard and Machinery Works (MHI Kobe), Main Plant, 1-1, Wadasaki-cho 1-chome, Hyogo-ku, Kobe, 652-8585 Japan.  
Tel: (81) 78 672 2221 2224, Fax: (81) 78 672 2245, Web site: [http://www.mhi.co.jp/kobe/mhikobe-e/products/etc/siken/high\\_index.html](http://www.mhi.co.jp/kobe/mhikobe-e/products/etc/siken/high_index.html).

## European and Asian Wind Tunnels



**60 cm Trisonic Wind Tunnel, Mitsubishi Heavy Industries Kobe Shipyard and Machinery Works (MHI Kobe), Kobe, Japan.**



# European and Asian Wind Tunnels

Supersonic

Japan

Installation Name	Test Section Size	Speed Range
Mitsubishi Heavy Industries Kobe Shipyard and Machinery Works (MHI Kobe), Kobe, Japan		0.2 to 2.5 Mach
		Temperature Range
	Date Built/Upgrade	90 to 300° K
Facility Name	Currently in the planning stage	Reynolds Number (million)
Continuous Circulation Cryogenic Wind Tunnel		up to 240
	Cost	Dynamic Pressure
		110 to 500 kPa
	Operational Status	Stagnation Pressure
	Currently in the planning stage.	

## Supplementary Technical Parameters

Liquid nitrogen injected upstream; gaseous nitrogen exhausted downstream. Blowing time maximum 30 minutes.

## Data Acquisition

## Testing Capabilities/Current Programs

To be used for prediction of turbulence transition and flow separation points.

## Planned Improvements

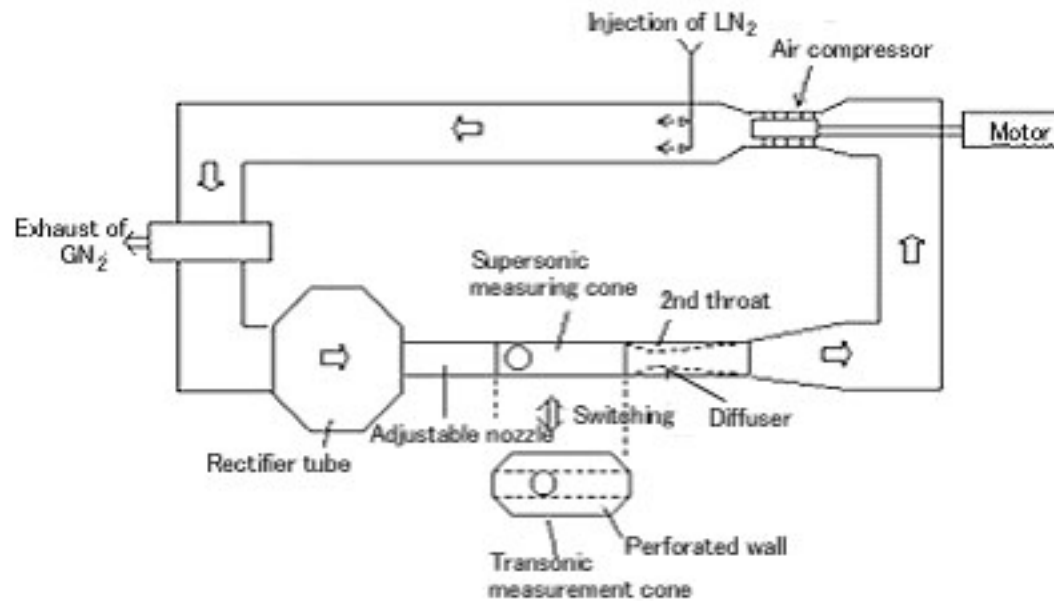
Quiet supersonic nozzle.

## User Fees

## Contact Information

Mitsubishi Heavy Industries Kobe Shipyard and Machinery Works (MHI Kobe), Main Plant, 1-1, Wadasaki-cho 1-chome, Hyogo-ku, Kobe, 652-8585 Japan.  
Tel: (81) 78 672 2221-2224, Fax: (81) 78 672 2245, Web site: [http://www.mhi.co.jp/kobe/mhikobe-e/products/etc/siken/high\\_index.html](http://www.mhi.co.jp/kobe/mhikobe-e/products/etc/siken/high_index.html).

## European and Asian Wind Tunnels



**Continuous Circulation Cryogenic Wind Tunnel,  
Mitsubishi Heavy Industries Kobe Shipyard and Machinery Works (MHI Kobe),  
Kobe, Japan.**

# European and Asian Wind Tunnels

Supersonic

Netherlands

Installation Name	Test Section Size	Speed Range
Delft University of Technology (TUDELFT), High-Speed Laboratory, Delft, The Netherlands	150 x 150 mm	0.7 to 3.0 Mach
		Temperature Range
	Date Built/Upgrade	
Facility Name		Reynolds Number (million)
ST-15 Wind Tunnel	Cost	
		Dynamic Pressure
	Operational Status	
	Presumed active as of October 2005	Stagnation Pressure

## Supplementary Technical Parameters

Blow-down wind tunnel. Runtime 800 seconds. Interchangeable nozzle blocks.

## Data Acquisition

## Testing Capabilities/Current Programs

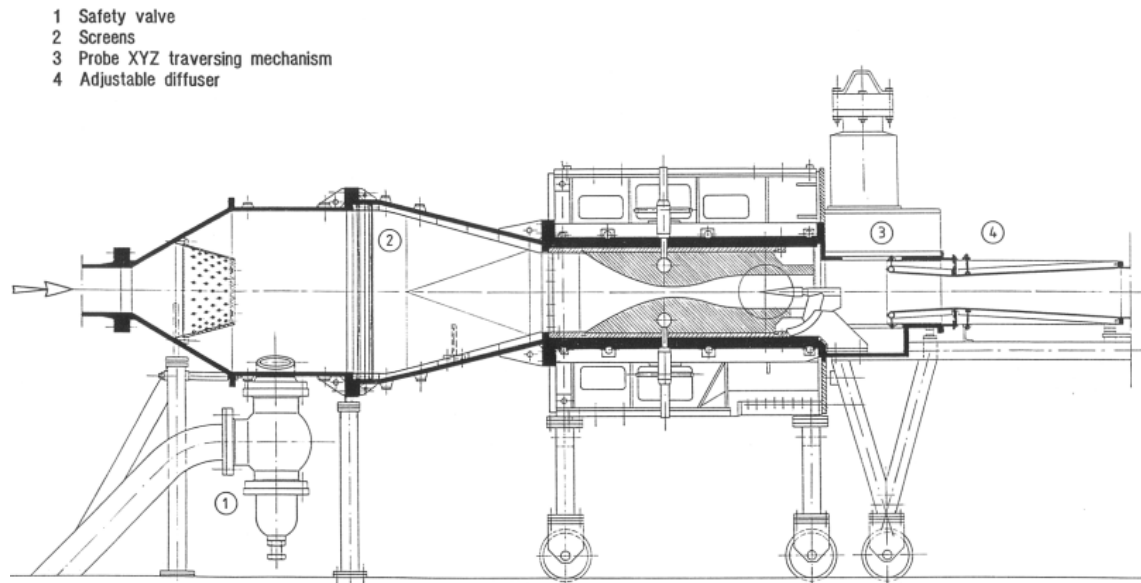
## Planned Improvements

## User Fees

## Contact Information

High-Speed Laboratory, Delft University of Technology (TUDELFT), Kluyverweg 1, 2629 HS Delft, The Netherlands.  
Tel: (31) 15 2784501, Fax: (31) 15 2787077, Web site: [http://www.aero.lr.tudelft.nl/ae\\_facilities\\_fr.html](http://www.aero.lr.tudelft.nl/ae_facilities_fr.html).

## European and Asian Wind Tunnels



ST-15 Wind Tunnel

**ST-15 Wind Tunnel, Delft University of Technology (TUDELFT), Delft, The Netherlands.**

# European and Asian Wind Tunnels

Supersonic

Netherlands

Installation Name	Test Section Size	Speed Range
Delft University of Technology (TUDELFT), High-Speed Laboratory, Delft, The Netherlands	30 x 30 mm	1.5 to 3.5 Mach
		Temperature Range
	Date Built/Upgrade	
Facility Name	1969	Reynolds Number (million)
ST-3 Vacuum Wind Tunnel	Cost	
		Dynamic Pressure
	Operational Status	
	Presumed active as of October 2005	Stagnation Pressure

## Supplementary Technical Parameters

Supersonic, small vacuum wind tunnel. Runtime 2 hours. Semiflexible symmetrical or fixed asymmetrical test section selectable, 50 kW vacuum pump, silica gel dryer.

## Data Acquisition

## Testing Capabilities/Current Programs

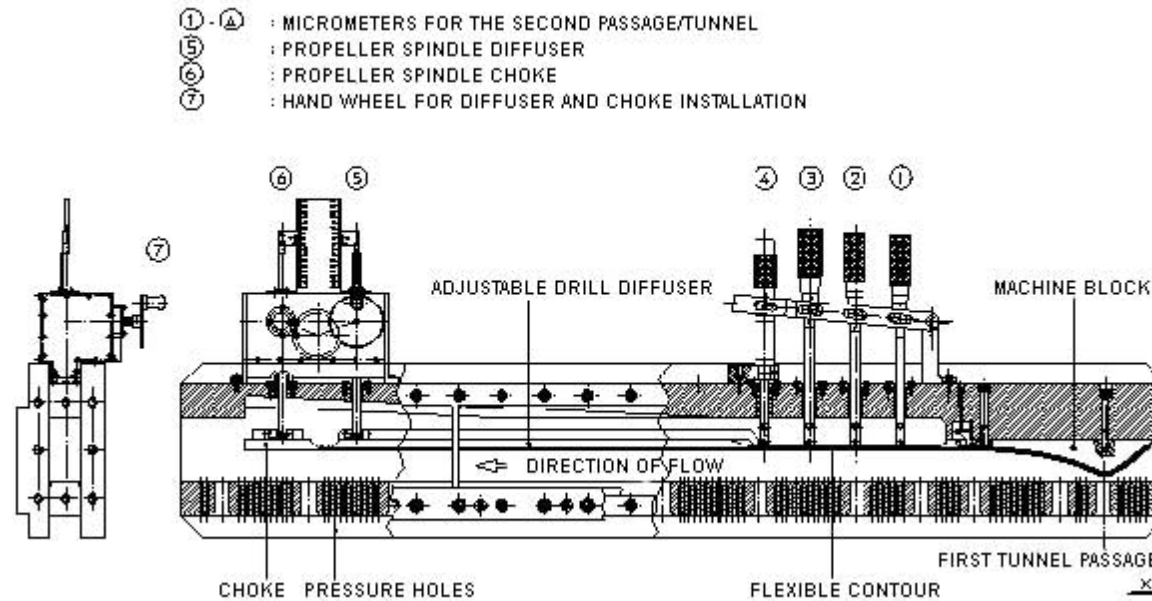
## Planned Improvements

## User Fees

## Contact Information

High-Speed Laboratory, Delft University of Technology (TUDELFT), Kluyverweg 1, 2629 HS Delft, The Netherlands.  
Tel: (31) 15 2784501, Fax : (31) 15 2787077, Web site: [http://www.aero.lr.tudelft.nl/ae\\_facilities\\_fr.html](http://www.aero.lr.tudelft.nl/ae_facilities_fr.html).

## European and Asian Wind Tunnels



**ST-3 Vacuum Wind Tunnel, Delft University of Technology (TUDELFT), Delft, The Netherlands.**

# European and Asian Wind Tunnels

Supersonic

Netherlands

Installation Name	Test Section Size	Speed Range
Delft University of Technology (TUDELFT), High-Speed Laboratory, Delft, The Netherlands	280 x (250-270) mm (closed or slotted)	#1: 0.5 to 0.85 Mach (subsonic), #2: 1.15 to 4.2 Mach (supersonic)
		Temperature Range
	Date Built/Upgrade	
Facility Name		Reynolds Number (million)
TST-27 Transonic/Supersonic Wind Tunnel		38 (transonic) to 130 (Mach 4.0)
	Cost	Dynamic Pressure
	Operational Status	Stagnation Pressure
	Presumed active as of October 2005	High

## Supplementary Technical Parameters

Blow-down wind tunnel. Runtime 350 seconds. Single jack semi-flexible nozzle. 220-kW electric motor.

## Data Acquisition

## Testing Capabilities/Current Programs

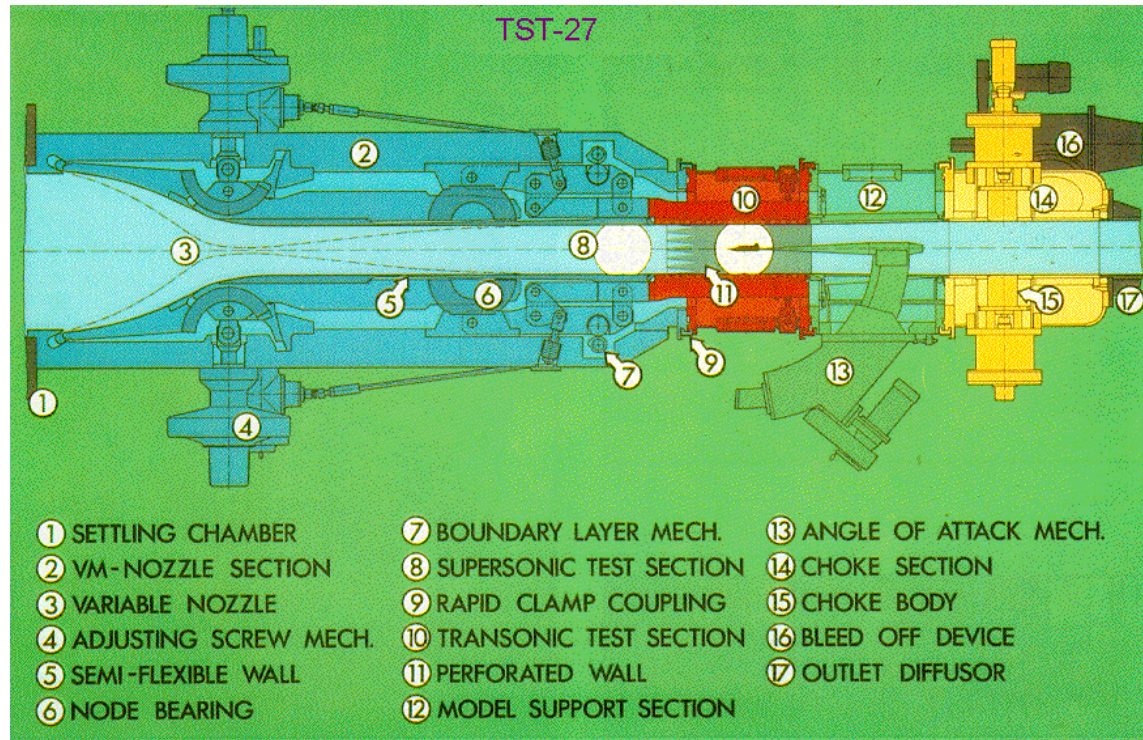
## Planned Improvements

## User Fees

## Contact Information

High-Speed Laboratory, Delft University of Technology (TUDELFT), Kluyverweg 1, 2629 HS Delft, The Netherlands.  
Tel: (31) 15 2784501, Fax : (31) 15 2787077, Web site: [http://www.aero.lr.tudelft.nl/ae\\_facilities\\_fr.html](http://www.aero.lr.tudelft.nl/ae_facilities_fr.html).

## European and Asian Wind Tunnels



**TST-27 Transonic Wind Tunnel, Delft University of Technology (TUDELFT), Delft, The Netherlands.**



# European and Asian Wind Tunnels

Supersonic

Netherlands

<b>Installation Name</b>	<b>Test Section Size</b>	<b>Speed Range</b>
German-Dutch Wind Tunnels (DNW), Amsterdam, The Netherlands	2.0 x 1.8 m	.01 to 1.35 Mach
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	300 to 310°K
<b>Facility Name</b>	1960/1997(new fan drive completed)	<b>Reynolds Number (million)</b>
2.0 x 1.8 m Continuous Pressurized Wind Tunnel (HST)	<b>Cost</b>	9
		<b>Dynamic Pressure</b>
	<b>Operational Status</b>	
	Presumed active as of September 2005	<b>Stagnation Pressure</b>
		0.2 to 4.0 bar

## Supplementary Technical Parameters

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Ir. G.H. Hegen, German-Dutch Wind Tunnels (DNW), Anthony Fokkerweg 2, 1059 CM Amsterdam, The Netherlands.  
Tel: (31) 527 24 8519, Fax: (31) 527 24 8582, Email: [info@dnw.aero](mailto:info@dnw.aero), Web site: <http://www.dnw.aero/>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Supersonic

Netherlands

<b>Installation Name</b>	<b>Test Section Size</b>	<b>Speed Range</b>
German-Dutch Wind Tunnels (DNW), Amsterdam, The Netherlands	1.2 x 1.2 m	1.2 to 4.0 Mach
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	290°K
<b>Facility Name</b>	1964/1973/1999	<b>Reynolds Number (million)</b>
Supersonic Blow-Down Wind Tunnel (SST)		15
	<b>Cost</b>	<b>Dynamic Pressure</b>
	<b>Operational Status</b>	<b>Stagnation Pressure</b>
	Presumed active as of September 2005	1470 kPa

## Supplementary Technical Parameters

The supersonic wind tunnel DNW-SST is a blow-down facility fed by an air storage vessel containing 600 m<sup>3</sup> of dry air at a maximum pressure of about 4,000 kPa.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

A flexible top and bottom walls were provided in 1973. In 1999, a major overhaul was carried out.

## User Fees

## Contact Information

Ir. G.H. Hegen, German-Dutch Wind Tunnels (DNW), Anthony Fokkerweg 2, 1059 CM Amsterdam, The Netherlands.  
Tel: (31) 527 24 8519, Fax: (31) 527 24 8582, Email: [info@dnw.aero](mailto:info@dnw.aero), Web site: <http://www.dnw.aero/>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Supersonic

Singapore

Installation Name	Test Section Size	Speed Range
National University of Singapore, Department of Mechanical Engineering, Singapore	1.2 x 1.2 m	0.25 to 4 Mach
		Temperature Range
	Date Built/Upgrade	
Facility Name	early 2004	Reynolds Number (million)
DSO Trisonic Wind Tunnel	Cost	
	US\$30 million (construction cost)	Dynamic Pressure
	Operational Status	
	Presumed operational as of December 2005.	Stagnation Pressure

## Supplementary Technical Parameters

Tunnel relocated from the United States. Refurbished and installed by Aero Systems Engineering (ASE) of St. Paul, Minnesota. A joint project of the Ministry of Defense and the National University of Singapore. Can operate at subsonic, transonic, and supersonic speeds.

## Data Acquisition

ASE 2000 control and data system

## Testing Capabilities/Current Programs

Supports the needs of Singapore Ministry of Defense in the area of aeronautics and to promote R&D activities in aerodynamics and aeronautics technology. The facility is also used by staff members of the Department of Mechanical Engineering at the National University of Singapore to carry out research and teaching activities related to aerodynamics.

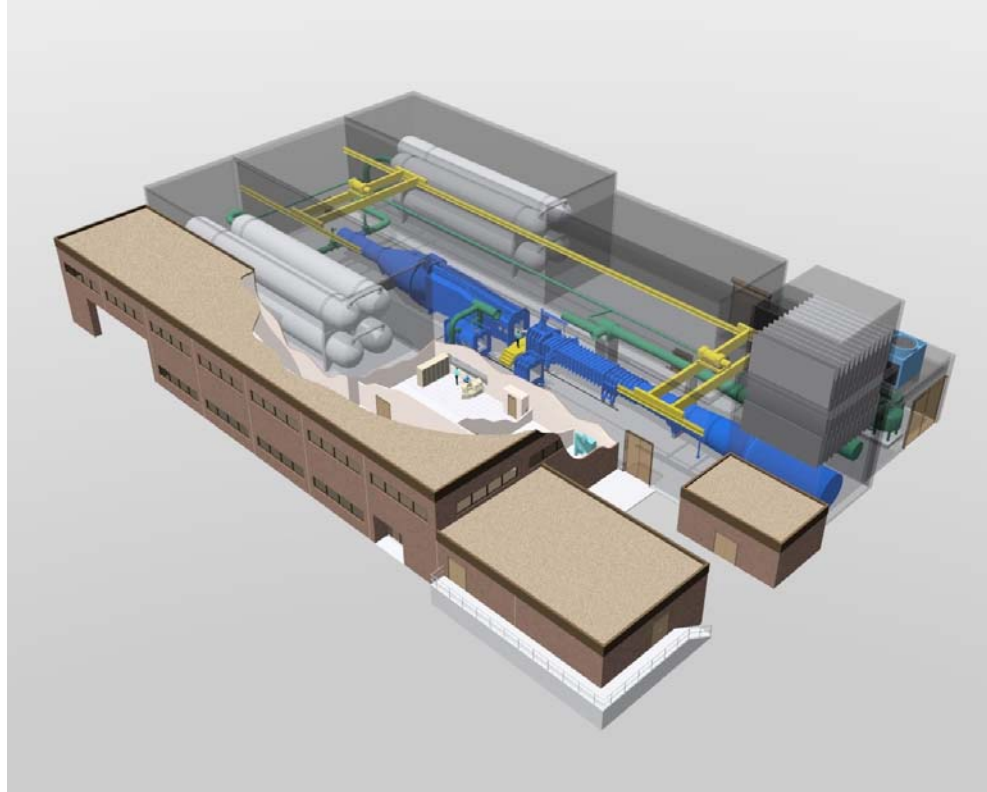
## Planned Improvements

## User Fees

## Contact Information

Chye-Lee Soo Leng, Department of Mechanical Engineering, Block EA #07-08, 9 Engineering Drive 1, Singapore 117576.  
Tel: (65) 6874 2212/6874 4498, Fax: (65) 6779 1459, Email: mpesec@nus.edu.sg, Web site: <http://www.me.nus.edu.sg/mehighlights/windtunnel.html>.

## European and Asian Wind Tunnels



**DSO Trisonic Wind Tunnel, National University in Singapore, Department of Mechanical Engineering, Singapore.**

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# European and Asian Wind Tunnels

Hypersonic

Belgium

Installation Name	Test Section Size	Speed Range
Von Karman Institute for Fluid Dynamics (VKI), Saint Genese, Belgium	12 cm (diameter)	6 Mach
		Temperature Range
	Date Built/Upgrade	550 to 575°K
Facility Name		Reynolds Number (million)
H-3 Hypersonic Wind Tunnel		3 to 30
	Cost	Dynamic Pressure
	Operational Status	Stagnation Pressure
	Presumed active as of September 2005	10 to 35 bar

## Supplementary Technical Parameters

Blow-down wind tunnel. The H-3 wind tunnel air is supplied from a pebble-bed, flow speed 1000 m/s, flow temperature –210 degrees C, flow pressure 0.007-0.025 bar.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

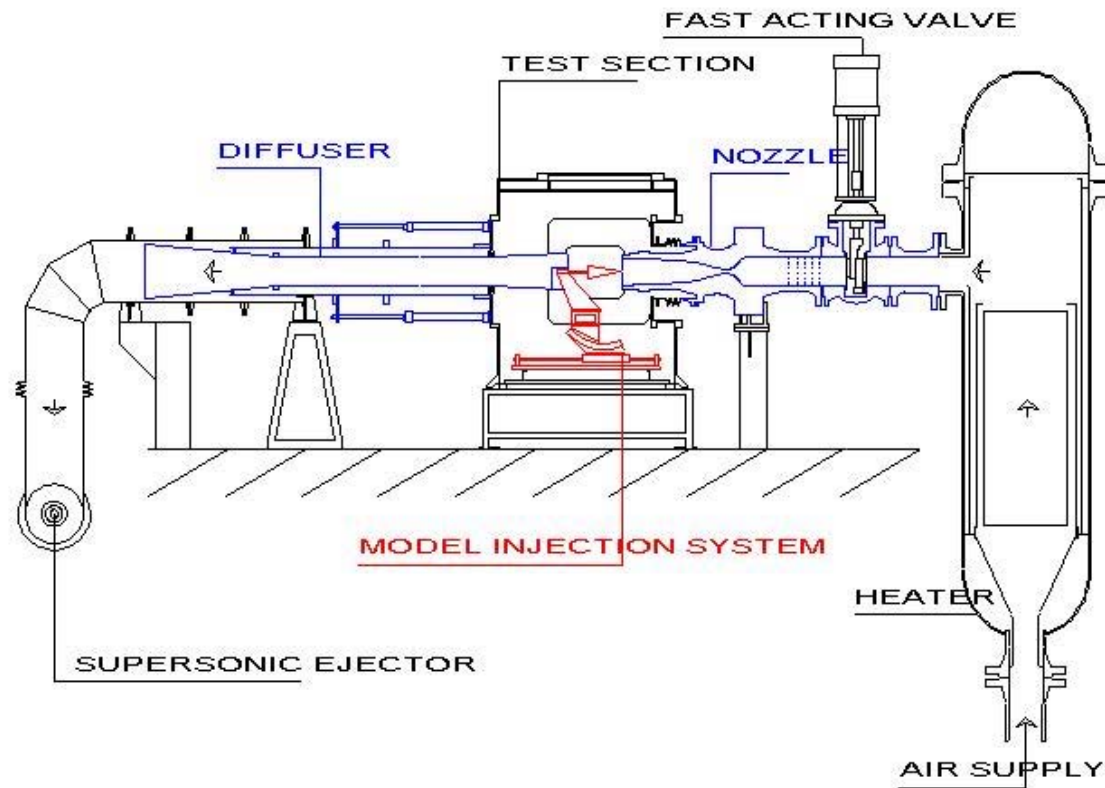
## User Fees

## Contact Information

Olivier Chazot, Von Karman Institute for Fluid Dynamics, B-1640 Rhode, Genese, Belgium.

Tel: (32) 02 359 11, Fax: (32) 02 359 96 00, Email: [chazot@vki.ac.be](mailto:chazot@vki.ac.be), Web site: <http://www.vki.ac.be/ar-dept/virtual/facility/h3/h3.html>.

## European and Asian Wind Tunnels



**H-3 Hypersonic Wind Tunnel, Von Karman Institute (VKI), St. Genese, Belgium.**

# European and Asian Wind Tunnels

Hypersonic

Belgium

<b>Installation Name</b>	<b>Test Section Size</b>	<b>Speed Range</b>
Von Karman Institute for Fluid Dynamics (VKI), Saint Genese, Belgium	0.43 (nozzle exit diameter)	15 to 20 Mach
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	
<b>Facility Name</b>		<b>Reynolds Number (million)</b>
Longshot Free-Piston Gun Wind Tunnel	<b>Cost</b>	5 to 15
		<b>Dynamic Pressure</b>
	<b>Operational Status</b>	<b>Stagnation Pressure</b>
	Presumed active as of September 2005	

## Supplementary Technical Parameters

Free piston tunnel. A Mach-14 contoured nozzle of 0.43 m exit diameter and a 6° conical nozzle of 0.60 m exit diameter.

## Data Acquisition

64 Channels, 50 KHz.

## Testing Capabilities/Current Programs

## Planned Improvements

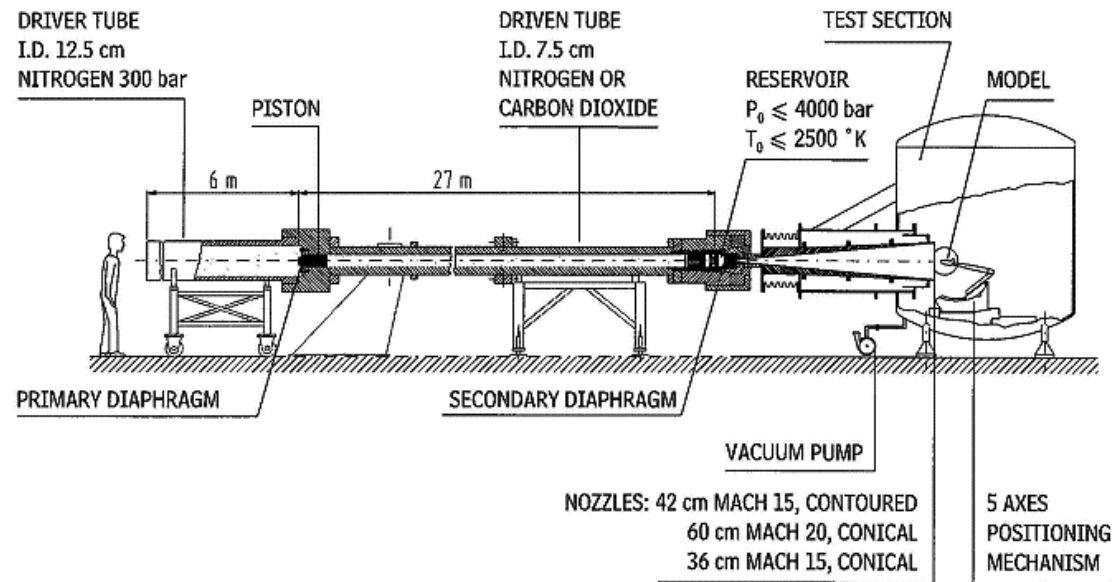
## User Fees

## Contact Information

Olivier Chazot, Von Karman Institute for Fluid Dynamics, B-1640 Rhode, Genese, Belgium.

Tel: (32) 02 359 11, Fax: (32) 02 359 96 00, Email: [chazot@vki.ac.be](mailto:chazot@vki.ac.be), Web site: <http://www.vki.ac.be/ar-dept/virtual/facility/longshot/longshot.html>.

## European and Asian Wind Tunnels



**Longshot Free-Piston Gun Wind Tunnel,  
Von Karman Institute for Fluid Dynamics (VKI),  
St. Genese, Belgium.**

# European and Asian Wind Tunnels

Hypersonic

China

Installation Name	Test Section Size	Speed Range
China Academy of Aerospace Aerodynamics (CAAA), Beijing, China AKA: Beijing Institute of Aerodynamics (BIA) or 701st Institute of the China Aerospace Science & Technology Corp (CASC)	0.4 to 0.5 (nozzle exit diameter)	8, 12, 15 Mach
		Temperature Range
	Date Built/Upgrade	900 to 1500°K
		Reynolds Number (million)
Facility Name		30 (max)
FD-20 Hypervelocity Conventional Piston-Gun Wind Tunnel	Cost	Dynamic Pressure
		6 to 100 Mpa
	Operational Status	Stagnation Pressure
	Presumed active as of November 2005	30 to 750 bar

## Supplementary Technical Parameters

Nozzle exit diameter 0.4 – 0.5 m. Both driver gas and test gas are air and nitrogen. Run time 15 – 30 m/sec.

## Data Acquisition

## Testing Capabilities/Current Programs

Pressure and force measurements of hypervelocity vehicle models, aerodynamic heat transfer tests, model free flight dynamic stability, stage separation, hot and cold jet simulation, rocket firing, shock interaction, and flow visualization.

## Planned Improvements

## User Fees

## Contact Information

Li Feng (Director), China Academy of Aerospace Aerodynamics (CAAA), 17 Yungang West Road, Fengtai District, Beijing 100074, China.  
Tel: (86) 10 68740603, Fax: (86) 10 68374758, Email: caaa@bia701.com, Web site: [http://www.bia701.com/html/e\\_19\\_fd22\\_10.htm](http://www.bia701.com/html/e_19_fd22_10.htm).

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Hypersonic

China

Installation Name	Test Section Size	Speed Range
China Academy of Aerospace Aerodynamics (CAAA), Beijing, China AKA: Beijing Institute of Aerodynamics (BIA) or 701st Institute of the China Aerospace Science & Technology Corp (CASC)	0.42 to 0.5 (nozzle exit diameter)	15, 20, 25 Mach
		Temperature Range
	Date Built/Upgrade	1,500 to 3,000°K
Facility Name		Reynolds Number (million)
FD-22 Hypervelocity, Longshot Free Piston-Gun Wind Tunnel	Cost	30 (max)
		Dynamic Pressure
		100 Mpa
	Operational Status	Stagnation Pressure
	Presumed active as of November 2005	4000 bar

## Supplementary Technical Parameters

Nozzle exit diameter 0.42 – 0.50 m. Both driver gas and test gas are nitrogen. Run time 20 – 40 m/sec. This institute also has several arc-heated wind tunnels ranging from subsonic to hypersonic, but details are not provided.

## Data Acquisition

## Testing Capabilities/Current Programs

Pressure and force measurements of hypervelocity vehicle models, aerodynamic heat transfer tests, model free flight dynamic stability, stage separation, hot and cold jet simulation, rocket firing, shock interaction, and flow visualization.

## Planned Improvements

## User Fees

## Contact Information

Li Feng (Director), China Academy of Aerospace Aerodynamics (CAAA), 17 Yungang West Road, Fengtai District, Beijing 100074, China.  
Tel: (86) 10 68740603, Fax: (86) 10 68374758, Email: caaa@bia701.com, Web site: [http://www.bia701.com/html/e\\_19\\_fd22\\_10.htm](http://www.bia701.com/html/e_19_fd22_10.htm).

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**



# European and Asian Wind Tunnels

Hypersonic

China

Installation Name	Test Section Size	Speed Range
China Academy of Aerospace Aerodynamics (CAAA), Beijing, China AKA: Beijing Institute of Aerodynamics (BIA) or 701st Institute of the China Aerospace Science & Technology Corp (CASC)	1.2 x 1.4 x 1.8 m (two lines)	Line #1: 5 to 8 Mach; Line #2: 10 to 12 Mach
Facility Name Hypersonic Wind Tunnel	Date Built/Upgrade	Temperature Range
	Cost	Reynolds Number (million)
	Operational Status	Dynamic Pressure
	Presumed active as of November 2005	Stagnation Pressure

## Supplementary Technical Parameters

Free jet, intermittent type. Nozzle exit 0.5 m diameter. Body of the tunnel is divided into two lines: plate heater in the 1st, pebble bed heater in the 2nd. Can perform unconventional tests continuously for over 10 minutes. This wind tunnel is part of a three-tunnel hypersonic wind tunnel complex. The other two are research tunnels, one of which has a Mach number range of 3.5 – 8.0, and the other of which has a Mach number range of 5.0 – 10.

## Data Acquisition

## Testing Capabilities/Current Programs

Tests on: aircraft model aerodynamics, aircraft aero-dynamic heat transfer and coating scouring, engine jet flow, aero-optics. Measurement of: dynamic and stagnation pressure on aircraft models, reentry body aerodynamic characteristics, control surface hinge moment characteristics. Simulations of: interstage separation, thrust vector control, low-temperature ablation and particle erosion. Research on boundary layer transitions and shockwave-boundary layer interference.

## Planned Improvements

## User Fees

## Contact Information

Li Feng (Director), China Academy of Aerospace Aerodynamics (CAAA), 17 Yungang West Road, Fengtai District, Beijing 100074, China.  
Tel: (86) 10 68740603, Fax: (86) 10 68374758, Email: caaa@bia701.com, Web site: [http://www.bia701.com/html/e\\_18\\_f500\\_04.htm](http://www.bia701.com/html/e_18_f500_04.htm).

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Hypersonic

China

<b>Installation Name</b>	<b>Test Section Size</b>	<b>Speed Range</b>
Key Laboratory of High-Temperature Gas Dynamics (LHD), Beijing, China		5.6 Mach
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	2,000°K
<b>Facility Name</b>		<b>Reynolds Number (million)</b>
Hypersonic Propulsion Test Facility (HPTF)	<b>Cost</b>	
		<b>Dynamic Pressure</b>
		5 Mpa
	<b>Operational Status</b>	<b>Stagnation Pressure</b>
	Presumed active as of November 2005	

## Supplementary Technical Parameters

Flow rate: 4 kg/sec for 10 seconds.

## Data Acquisition

## Testing Capabilities/Current Programs

Model tests of scramjets.

## Planned Improvements

## User Fees

## Contact Information

Professor Jiang Zonglin (Director), Key Laboratory of High Temperature Gas Dynamics (LHD), No.15 Beisihuanxi Road, Beijing 100080, China.  
Tel (Lab): (86) 10 62548132, Tel (Director): (86) 10 62545947, Fax (Director): (86) 10 62657081, Email (Director): zljiang@imech.ac.cn, Web site: <http://www.lhd.cn>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Hypersonic

China

Installation Name	Test Section Size	Speed Range
Key Laboratory of High-Temperature Gas Dynamics (LHD), Beijing, China		7 to 20 Mach
		Temperature Range
	<b>Date Built/Upgrade</b>	ip to 9,000°K
Facility Name	Lab - 1994, wind tunnel - unknown.	Reynolds Number (million)
JF-10 Oxygen-Hydrogen Detonation-Driven High Enthalpy Shock Wind Tunnel	<b>Cost</b>	
		Dynamic Pressure
	<b>Operational Status</b>	
	Presumed active as of November 2005	Stagnation Pressure
		800 bar

## Supplementary Technical Parameters

## Data Acquisition

## Testing Capabilities/Current Programs

Experimental research on real gas effects of high temperature flows.

## Planned Improvements

## User Fees

## Contact Information

Professor Jiang Zonglin (Director), Key Laboratory of High Temperature Gas Dynamics (LHD), No.15 Beisihuanxi Road, Beijing 100080, China.  
Tel (Lab): (86) 10 62548132, Tel (Director): (86) 10 62545947, Fax (Director): (86) 10 62657081, Email (Director): zljiang@imech.ac.cn, Web site: <http://www.lhd.cn>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Hypersonic

China

Installation Name	Test Section Size	Speed Range
Key Laboratory of High-Temperature Gas Dynamics (LHD), Beijing, China	0.8 m (nozzle exit diameter)	6.5 to 15 Mach
		Temperature Range
	Date Built/Upgrade	
Facility Name	1994	Reynolds Number (million)
JF-8 Hypersonic Shock Wind Tunnel Gun Wind Tunnel	Cost	
		Dynamic Pressure
	Operational Status	
	Presumed active as of November 2005	Stagnation Pressure

## Supplementary Technical Parameters

Run time: 20 – 30 m/sec.

## Data Acquisition

## Testing Capabilities/Current Programs

Experimental research on vehicle aerodynamic force and heat transfer of hypersonic flight.

## Planned Improvements

## User Fees

## Contact Information

Professor Jiang Zonglin (Director), Key Laboratory of High Temperature Gas Dynamics (LHD), No.15 Beisihuanxi Road, Beijing 100080, China.  
Tel (Lab): (86) 10 62548132, Tel (Director): (86) 10 62545947, Fax (Director): (86) 10 62657081, Email (Director): zljiang@imech.ac.cn, Web site: <http://www.lhd.cn>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**



# European and Asian Wind Tunnels

Hypersonic

France

Installation Name	Test Section Size	Speed Range
ONERA French Aeronautics and Space Research Center, Chalais-Meudon, France	#1: 0.190 m; #2: 0.325 m (nozzle exit diameters)	#1: 3, 4 Mach; #2: 5, 6, 7 Mach
		Temperature Range
	Date Built/Upgrade	up to 700°K
Facility Name		Reynolds Number (million)
R2Ch Hypersonic Wind Tunnel	Cost	
		Dynamic Pressure
	Operational Status	
	Presumed active as of September 2005	Stagnation Pressure
		variable up to 80 bar

## Supplementary Technical Parameters

Long blow-downs from 10 to 60 seconds. Free test section. Variable stagnation temperature up to 700°K, Maximum flow rate: Qmax = 60 kg/s.

## Data Acquisition

## Testing Capabilities/Current Programs

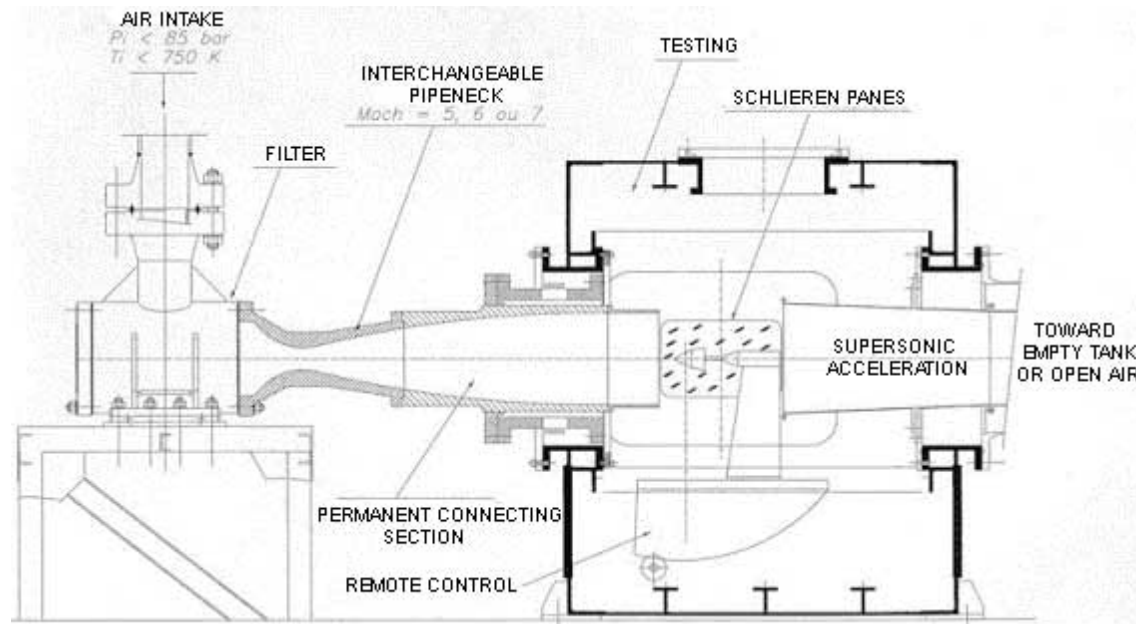
## Planned Improvements

## User Fees

## Contact Information

Bruno Chanetz, Lucien Morzenski, Meudon Center, ONERA – DAFE 8, rue des Vertugadins 92190 Meudon, France.  
 Tel (Chanetz): (33) 1 46 23 51 76, Tel (Morzenski): (33) 1 46 23 51 46, Fax: (33) 1 46 23 51 58, Email (Chanetz): chanetz@onera.fr, Email (Morzenski): morzenski@onera.fr, Web site: <http://www.onera.fr/dafe-en/r1r2ch/index.html>.

## European and Asian Wind Tunnels



**R2Ch Hypersonic Wind Tunnel, ONERA French Aeronautics and Space Research Center, Chalais-Meudon, France.**

# European and Asian Wind Tunnels

Hypersonic

France

Installation Name	Test Section Size	Speed Range
ONERA French Aeronautics and Space Research Center, Chalais-Meudon, France	0.350 m (nozzle exit diameter, free test section)	10 Mach
		Temperature Range
	Date Built/Upgrade	1,100° K
Facility Name		Reynolds Number (million)
R3Ch Hypersonic Wind Tunnel	Cost	
		Dynamic Pressure
	Operational Status	
	Presumed active as of September 2005	Stagnation Pressure
		variable 12 to 120 bar

## Supplementary Technical Parameters

Long blow-downs: 10 seconds. Stagnation temperature: 1,100° K. Maximum flow rate:  $Q_{max} = 2$  kg/s. Rapid initiation by three-way valve.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Bruno Chanetz, Lucien Morzenski, Meudon Center, ONERA – DAFE 8, rue des Vertugadins 92190 Meudon, France.

Tel (Chanetz): (33) 1 46 23 51 76, Tel (Morzenski): (33) 1 46 23 51 46, Fax: (33) 1 46 23 51 58, Email (Chanetz): chanetz@onera.fr, Email (Morzenski): morzenski@onera.fr, Web site: <http://www.onera.fr/dafe-en/r1r2ch/contacts.html>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Hypersonic

France

Installation Name	Test Section Size	Speed Range
ONERA French Aeronautics and Space Research Center, Chalais-Meudon, France	0.350 m (nozzle exit diameter, free test section)	10 Mach
		Temperature Range
	Date Built/Upgrade	1,100°K
Facility Name		Reynolds Number (million)
R5Ch Hypersonic Wind Tunnel		Unit Reynolds number in free flow: 167,000 m-1
	Cost	Dynamic Pressure
	Operational Status	Stagnation Pressure
	Presumed active as of September 2005	2.5 bar (variable)

## Supplementary Technical Parameters

Hypersonic flows, continuous molecular regime. Blow-down duration: up to 90 seconds. Stagnation temperature: 1,100°K. Maximum flow rate .030 kg/s. Rapid initiation by three-way valve.

## Data Acquisition

## Testing Capabilities/Current Programs

Investigation of hypersonic flows in continuous molecular regime at very low Reynolds numbers (simulating fully laminar flows).

## Planned Improvements

## User Fees

## Contact Information

Bruno Chanetz, Lucien Morzenski, Meudon Center, ONERA – DAFE 8, rue des Vertugadins 92190 MEUDON, France.  
 Tel (Chanetz): (33) 1 46 23 51 76, Tel (Morzenski): (33) 1 46 23 51 46, Fax: (33) 1 46 23 51 58, Email (Chanetz): chanetz@onera.fr, Email (Morzenski): morzenski@onera.fr, Web site: <http://www.onera.fr/dafe-en/r1r2ch/contacts.html>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Hypersonic

France

Installation Name	Test Section Size	Speed Range
ONERA French Aeronautics and Space Research Center, Le Fauga Mauzac Center, Le Fauga Mauzac, France	#1: 670 mm; #2: 670 mm; #3: 430 mm; #4: 930 mm (nozzle exit diameters)	#1: 8 to 17 Mach; #2: 7 to 13 Mach; #3: 6 to 11 Mach; #4: 9 to 21 Mach
		Temperature Range
	Date Built/Upgrade	
Facility Name	1988-1991	Reynolds Number (million)
F4 Arc-Heated High-Enthalpy Hypersonic Wind Tunnel	Cost	#1: 2; #2: 3; #3: 5; #4: 1
		Dynamic Pressure
	Operational Status	
	Presumed active as of September 2005	Stagnation Pressure
		500 bar

## Supplementary Technical Parameters

The usual blowdown duration obtained is 200 m/s. The test conditions can reach a total pressure of 500 bar together with an enthalpy of 16,5 mJ/kg (reduced H/RTo = 200).

## Data Acquisition

Data acquisition system with 72 channels. Each one has an analog conditioner, an amplifier filter, a 16 bit 50 kHz analog to digital converter and a buffer memory of 64000 samples.

## Testing Capabilities/Current Programs

Hypersonic spacecraft reentry.

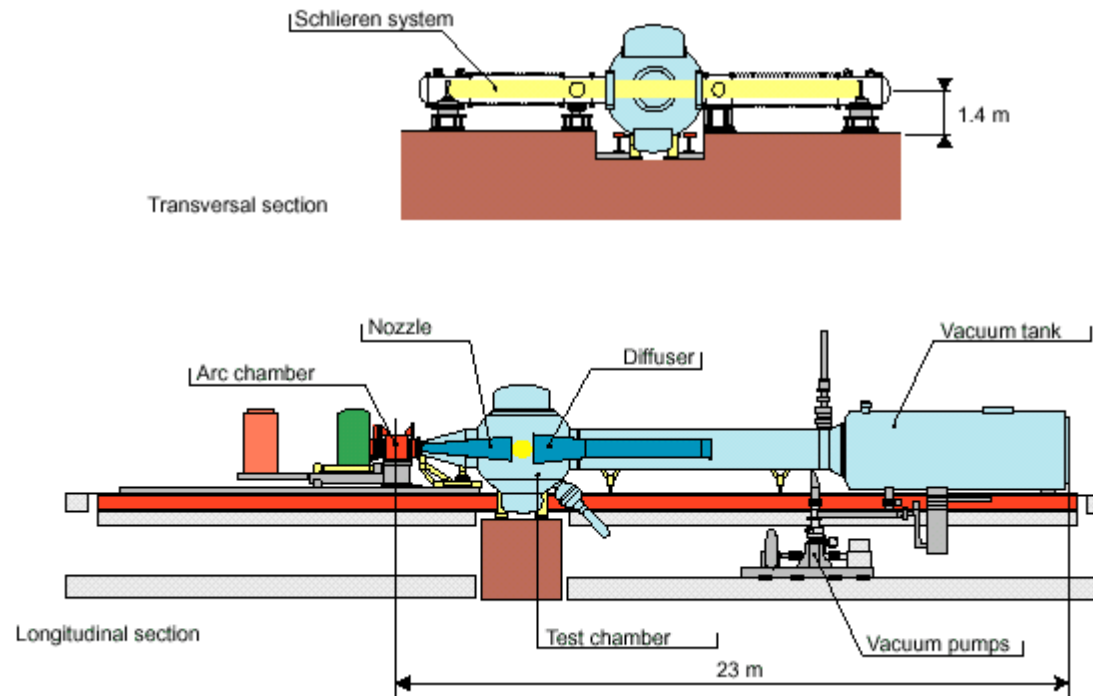
## Planned Improvements

## User Fees

## Contact Information

Jean-Claude Traineau (Director), Le Fauga-Mauzac Wind Tunnel Department (DSFM), ONERA - GMT, F-31410 NOE, Le Fauga-Mauzac, France.  
Tel: (33) 5 61 56 63 01, Fax: (33) 5 61 56 63 63, E-mail: Jean-Claude.Traineau@onera.fr, Email: cfm@onera.fr, Web site: <http://www.onera.fr/gmt-en/table.html>,  
<http://www.onera.fr/geographie-en/fauga-mauzac.html>.

## European and Asian Wind Tunnels



**F4 Arc-Heated, High-Enthalpy Hypersonic Wind Tunnel, ONERA French Aeronautics and Space Research Center,  
Le Fauga-Mauzac Center, Le Fauga-Mauzac, France.**



# European and Asian Wind Tunnels

Hypersonic

France

Installation Name	Test Section Size	Speed Range
ONERA French Aeronautics and Space Research Center, Modane-Avrieux, France	#1: 0.68 m; #2: 1 m; #3: 1 m (nozzle exit diameters, three interchangeable nozzles)	#1: 6.4 Mach, #2: 10 Mach, #3: M = 12 Mach
		Temperature Range
	Date Built/Upgrade	1,800°K
Facility Name	1970	Reynolds Number (million)
S4Ma Blow-Down Hypersonic Wind Tunnel		#1: 1.7; #2: 0.9; #3: 0.35
	Cost	Dynamic Pressure
	Operational Status	Stagnation Pressure
	Presumed active as of September 2005	up to 150 bar

## Supplementary Technical Parameters

## Data Acquisition

48 to 72 analog channels, extension up to 120 channels.

## Testing Capabilities/Current Programs

## Planned Improvements

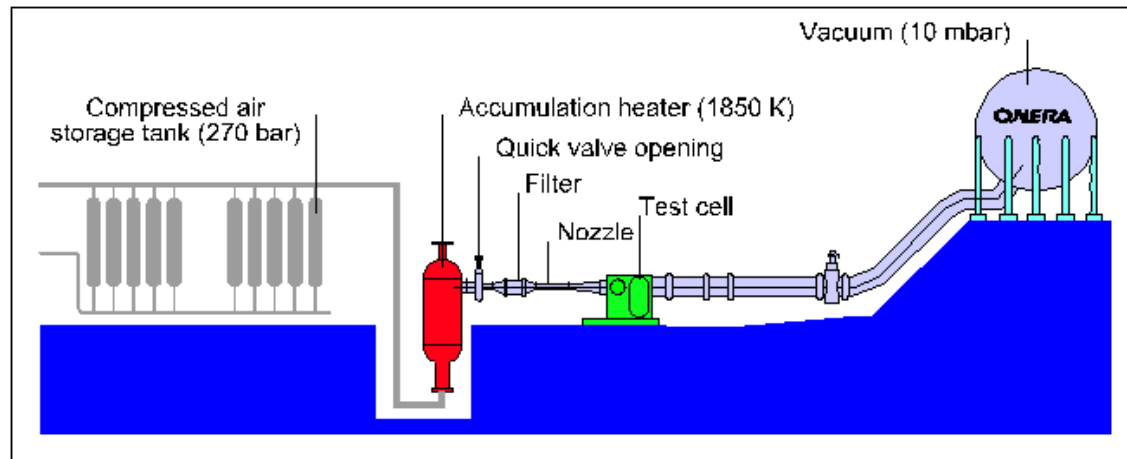
## User Fees

## Contact Information

Jean-Paul Bècle (Director), Modane-Avrieux Wind Tunnel Department, Onera, PO Box 215, F-73500 Modane, France.

Tel: (33) 4 79 20 20 91, Fax: (33) 4 79 20 21 68, Email: becle @ onera.fr, Web site: <http://www.onera.fr/gmt-en/wind-tunnels/s1ma-bis.html>.

## European and Asian Wind Tunnels



**S4Ma Hypersonic Wind Tunnel, ONERA French Aeronautics and Space Research Center, Modane-Avrieux, France.**

# European and Asian Wind Tunnels

Hypersonic

Germany

Installation Name	Test Section Size	Speed Range
Carolo-Wilhelmina Technical University at Braunschweig, Institute for Fluid Mechanics (ISM), Braunschweig, Germany	0.5 m (diameter)	6.0 Mach
		Temperature Range
	Date Built/Upgrade	
Facility Name		Reynolds Number (million)
Hypersonic Ludweig Wind Tunnel (HLB)		3 to 20
	Cost	Dynamic Pressure
	Operational Status	Stagnation Pressure
	Presumed active as of November 2005. 10 runs every hour	3 to 30 bar

## Supplementary Technical Parameters

Generates an intermittent Ma=6 air flow for unit Reynolds numbers up to 20 million. The test section size allows to test models of about 0.2 m length.

## Data Acquisition

Instrumentation includes schlieren, infrared thermography, and pressure gauges.

## Testing Capabilities/Current Programs

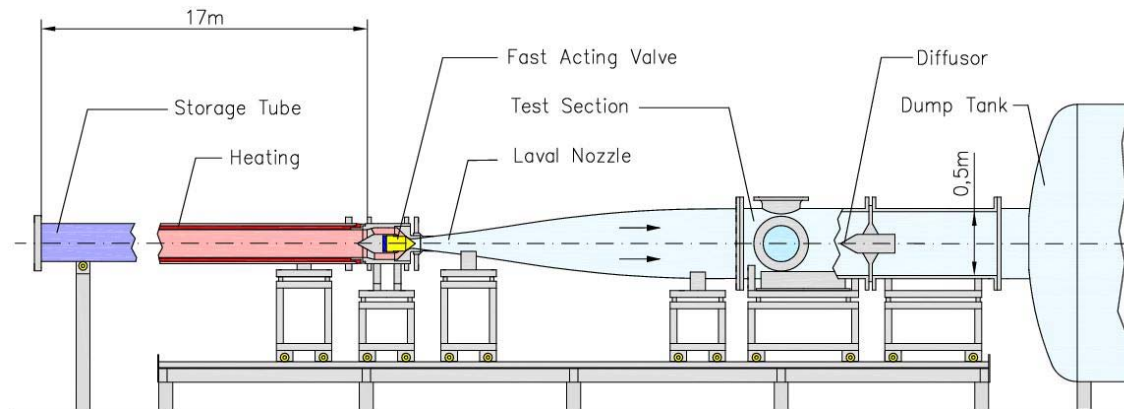
## Planned Improvements

## User Fees

## Contact Information

Prof. Dr.-Ing R. Radespiel, Department of Mechanical Engineering, Institut für Strömungsmechanik (ISM), Bienroder Weg, 338106 Braunschweig, Germany.  
Tel: (49) 531 391 2971, Fax: (49) 531 391 5952, Email: [ism@tu-braunschweig.de](mailto:ism@tu-braunschweig.de), Web site: <http://www.tu-braunschweig.de/ism/institut/wkanlagen/hlb>.

## European and Asian Wind Tunnels



**Hypersonic Ludweig Wind Tunnel (HLB), Carolo-Wilhelmina Technical University,  
Institute for Fluid Mechanics (ISM), Braunschweig, Germany.**

# European and Asian Wind Tunnels

Hypersonic

Germany

Installation Name	Test Section Size	Speed Range
German-Dutch Wind Tunnels (DNW), Göttingen, Germany	#1: 0.5 x 0.5 m, #2: 0.5 m (diameter)	#1: 2.9 to 4.65 Mach; #2: 5.0 to 6.9 Mach
		Temperature Range
	<b>Date Built/Upgrade</b>	#1: 300°K (max); #2: 700 °K (max)
Facility Name	1968	Reynolds Number (million)
Intermittent Ludwig Tube Wind Tunnel with Two Legs (RWG)	<b>Cost</b>	#1: 3.5; #2: 2.2
		Dynamic Pressure
	<b>Operational Status</b>	Stagnation Pressure
	Presumed active as of September 2005	

## Supplementary Technical Parameters

Intermittent Ludwig tube with two legs ( $t = 0.4$  sec). Reynolds numbers represent flight altitudes from 10 to 50 km. The RWG has two 80 m long storage tubes (A and B), which are connected by a fast-action valve and exchangeable supersonic nozzles to the test section.

## Data Acquisition

## Testing Capabilities/Current Programs

Space vehicle and missile research and development (for example, HERMES, Sänger, ARD, CRV, and X-38).

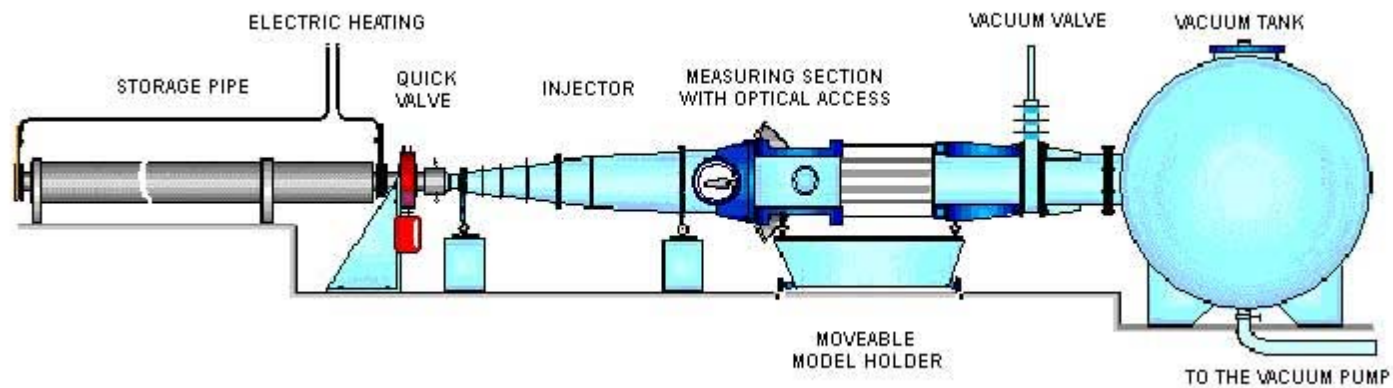
## Planned Improvements

## User Fees

## Contact Information

Dr.-Ing. K.-W. Bock, German-Dutch Wind Tunnels (DNW), Bunsenstrasse, 10, 37073 Göttingen, Germany.  
Tel: (49) 551 709 2820, Fax (49) 551 709 2888, Email: dnw-guk@dnw.aero, Web site: <http://www.dnw.aero/>.

## European and Asian Wind Tunnels



**Intermittent Ludwieg Tube with two legs (RWG), German-Dutch Tunnels (DNW), Göttingen, Germany.**

# European and Asian Wind Tunnels

Hypersonic

Italy

<b>Installation Name</b>	<b>Test Section Size</b>	<b>Speed Range</b>
Italian Aerospace Research Center (CIRA), Capua, Italy	2 m (diameter)	12 Mach
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	10,000°K
<b>Facility Name</b>		<b>Reynolds Number (million)</b>
Scirocco Plasma Hypersonic Wind Tunnel (PWT)	<b>Cost</b>	
		<b>Dynamic Pressure</b>
	<b>Operational Status</b>	<b>Stagnation Pressure</b>
	Presumed active as of October 2005	

## Supplementary Technical Parameters

Hypersonic, thermo-structural. The Scirocco facility is a plasma hypersonic wind tunnel, based on the electric arc heater, with a maximum power of 70 MW .

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Italian Aerospace Research Center (Centro Italiano Ricerche Aerospaziali: CIRA), Via Maiorise, 81043 Capua, Italy.  
Tel: (39) 0823 623001, Email: [info@cira.it](mailto:info@cira.it), Web site: <http://www.cira.it/>.

## European and Asian Wind Tunnels



**Scirocco Plasma Hypersonic Wind Tunnel (PWT), Italian Aerospace Research Center (CIRA), Capua, Italy.**



# European and Asian Wind Tunnels

Hypersonic

Japan

Installation Name	Test Section Size	Speed Range
Japan Aerospace Exploration Agency (JAXA), Institute of Aerospace Technology (IAT), Aerospace Research Center (ARC), Wind Tunnel Technology Center (WINTEC), Tokyo, Japan	0.5 m (nozzle exit diameter)	5, 7, 9, 11 Mach
		Temperature Range
	Date Built/Upgrade	
Facility Name	1965	Reynolds Number (million)
0.5 m Hypersonic Wind Tunnel	Cost	
		Dynamic Pressure
	Operational Status	
	Presumed active as of December 2005	Stagnation Pressure
		1 to 1.85 Mpa

## Supplementary Technical Parameters

Built by Mitsubishi Heavy Industries. Intermittent blowdown, vacuum suction type wind tunnel. Free jet type test section. Two runs at 60 second duration each. Two interchangeable 18 m<sup>3</sup> air sources at 19.7 MPa each. Two 1150 m<sup>3</sup> vacuum tanks. Two 6500 m<sup>3</sup>/hour air blowers.

## Data Acquisition

## Testing Capabilities/Current Programs

Research on aerodynamics in a supersonic low-turbulence environment.

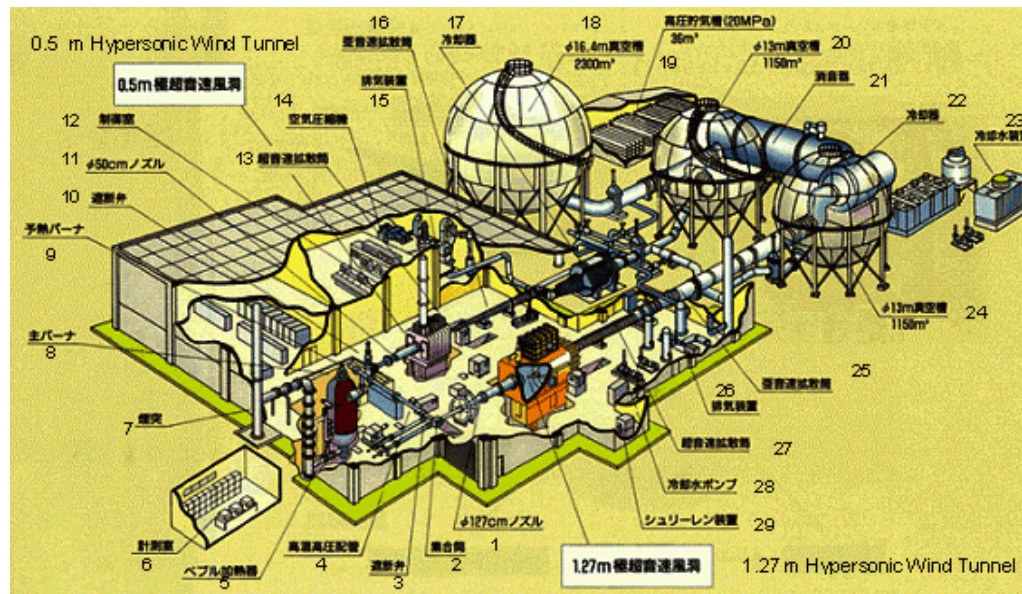
## Planned Improvements

## User Fees

## Contact Information

Dr. Masashi Shigemi (WINTEC Director), Japan Aerospace Exploration Agency (JAXA), Institute of Aerospace Technology (IAT), Aerospace Research Center (ARC), Wind Tunnel Technology Center (WINTEC), 7-44-1 Jindaiji Higashi-machi, Chofu-shi, Tokyo 182-8522, Japan.  
Tel: (81) 3 422 40 3000, Fax: (81) 3 422 40 3281, Email (Director): shigemi.masashi@jaxa.jp, Email: wintec@chofu.jaxa.jp, Web site: <http://www.iat.jaxa.jp/res/wttc/b04.html>.

# European and Asian Wind Tunnels



**1.27m 極超音速風洞 および 0.5m 極超音速風洞全体図**

(Schematic of the 1.27 m Hypersonic Wind Tunnel and the 0.5 m Hypersonic Wind Tunnel)

Exploration Agency (JAXA), Institute of Aerospace Technology (IAT), Aerospace Research Center (ARC), Wind Tunnel Technology Center (WINTeC), Tokyo, Japan.

- |  |  |
|--|--|
| 1. $\phi$ 127 cm Nozzle                | 16. Subsonic Diffuser                            |
| 2. Settling Chamber                    | 17. Cooler                                       |
| 3. Shut-Off Valve                      | 18. $\phi$ 16.4 m Vacuum Tank 2300 m             |
| 4. High Temperature High Pressure Pipe | 19. High Pressure Air Storage Tank (20 MPa) 36 m |
| 5. Vapor Heater                        | 20. $\phi$ 13 m Vacuum Tank 1150 m               |
| 6. Measurement Room                    | 21. Muffler                                      |
| 7. Smokestack                          | 22. Cooler                                       |
| 8. Main Burner                         | 23. Cooling Water System                         |
| 9. Preheating Burner                   | 24. $\phi$ 13 m Vacuum Tank 1150 m               |
| 10. Shut-Off Valve                     | 25. Subsonic Diffuser                            |
| 11. $\phi$ 50 cm Nozzle                | 26. Air Exhaust                                  |
| 12. Control Room                       | 27. Supersonic Diffuser                          |
| 13. Supersonic Diffuser                | 28. Cooling Water Pump                           |
| 14. Air Compressor                     | 29. Schlieren Device                             |
| 15. Air Exhaust                        |  |

# European and Asian Wind Tunnels

Hypersonic

Japan

Installation Name	Test Section Size	Speed Range
Japan Aerospace Exploration Agency (JAXA), Institute of Aerospace Technology (IAT), Aerospace Research Center (ARC), Wind Tunnel Technology Center (WINTeC), Tokyo, Japan	1.2 m (nozzle exit diameter)	12 to 20 Mach (4 to 7 km/s)
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	10,000°K (max)
<b>Facility Name</b>	1999	<b>Reynolds Number (million)</b>
High Enthalpy Shock Tunnel (HIEST)	<b>Cost</b>	
		<b>Dynamic Pressure</b>
	<b>Operational Status</b>	
	Presumed active as of December 2005	<b>Stagnation Pressure</b>
		150 Mpa (max)

## Supplementary Technical Parameters

Compression tube: length 42 m, diameter 0.6 m. Shock tube: length 17 m, diameter 0.18 m. Secondary air reservoir capacity: 7.7 m<sup>3</sup>. Piston weight: 300 – 720 kg. Slot diameter: 0.024 – 0.05 m. Test time: over 2 microseconds. Driver gas: helium, helium/argon. Driver gas temperature: maximum 4,000°K. World's largest free-piston shock wind tunnel. Maximum stagnation enthalpy: 25 MJ/kg.

## Data Acquisition

250 channels. Optical measurement system: schlieren device and double exposure hologram interferometer.

## Testing Capabilities/Current Programs

Simulation of the aerothermodynamic flow around reentry space vehicles and combustion characteristics of scramjet engines.

## Planned Improvements

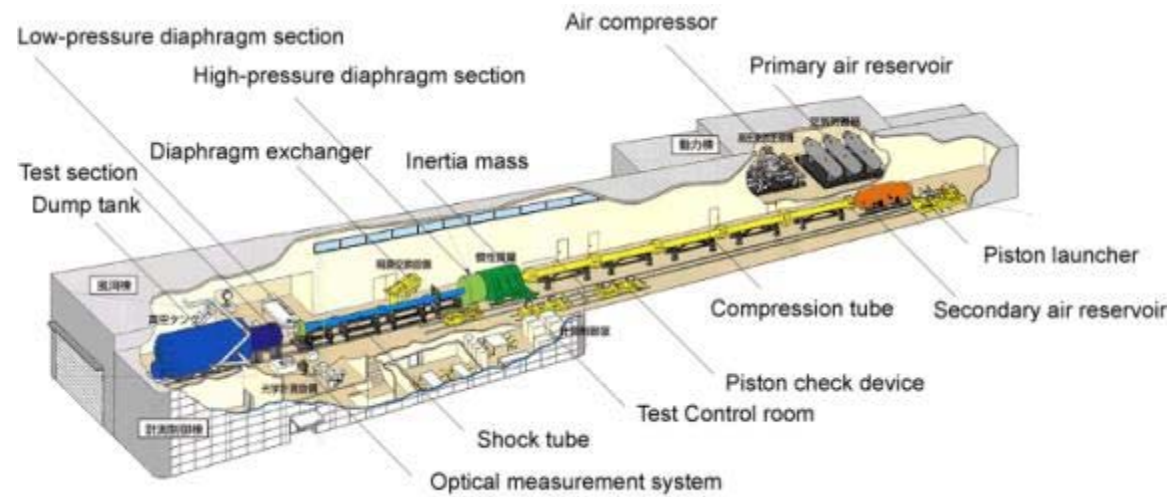
## User Fees

## Contact Information

Japan Aerospace Exploration Agency (JAXA), Institute of Aerospace Technology (IAT), Kakuda Space Center, 1 Koganezawa, Kimigaya, Kakuda-shi, Miyagi 981-1525, Japan.

Tel: (81) 224 68 3111, Fax: (81) 224 68 2860, Web site: [http://www.jaxa.jp/about/centers/kspc/index\\_e.html](http://www.jaxa.jp/about/centers/kspc/index_e.html).

## European and Asian Wind Tunnels



**High-Enthalpy Shock Wind Tunnel (HIEST), Japan Aerospace Exploration Agency (JAXA),  
Institute of Aerospace Technology (IAT), Kakuda Space Center, Miyagi, Japan.**

# European and Asian Wind Tunnels

Hypersonic

Japan

Installation Name	Test Section Size	Speed Range
Japan Aerospace Exploration Agency (JAXA), Institute of Aerospace Technology (IAT), Aerospace Research Center (ARC), Wind Tunnel Technology Center (WINTEC), Tokyo, Japan	0.44 m (nozzle exit diameter)	10, 12 Mach
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	1,400°K (continuous operation)
<b>Facility Name</b>	1967/1994 (upgrade)	<b>Reynolds Number (million)</b>
0.44 m Hypersonic Shock Wind Tunnel	<b>Cost</b>	
		<b>Dynamic Pressure</b>
	<b>Operational Status</b>	
	Presumed active as of December 2005	<b>Stagnation Pressure</b>
		0.5 to 4 Mpa

## Supplementary Technical Parameters

Diaphragm-less shock wind tunnel when under continuous operation. Two-stage compression shock wind tunnel when operating at high enthalpy. Test section: free jet type. Air flow duration 40 milliseconds when under continuous operation, 2 milliseconds at high enthalpy 8 MJ/kg.

## Data Acquisition

## Testing Capabilities/Current Programs

Research on aerodynamics in a supersonic low-turbulence environment.

## Planned Improvements

## User Fees

## Contact Information

Dr. Masashi Shigemi (WINTEC Director), Japan Aerospace Exploration Agency (JAXA), Institute of Aerospace Technology (IAT), Aerospace Research Center (ARC), Wind Tunnel Technology Center (WINTEC), 7-44-1 Jindaiji Higashi-machi, Chofu-shi, Tokyo 182-8522, Japan.  
Tel: (81) 3 422 40 3000, Fax: (81) 3 422 40 3281, Email (Director): shigemi.masashi@jaxa.jp, Email: wintec@chofu.jaxa.jp, Web site:  
<http://www.iat.jaxa.jp/res/wttc/b04.html>.

# European and Asian Wind Tunnels

## Schematic of the 0.44 m Hypersonic Shock Wind Tunnel

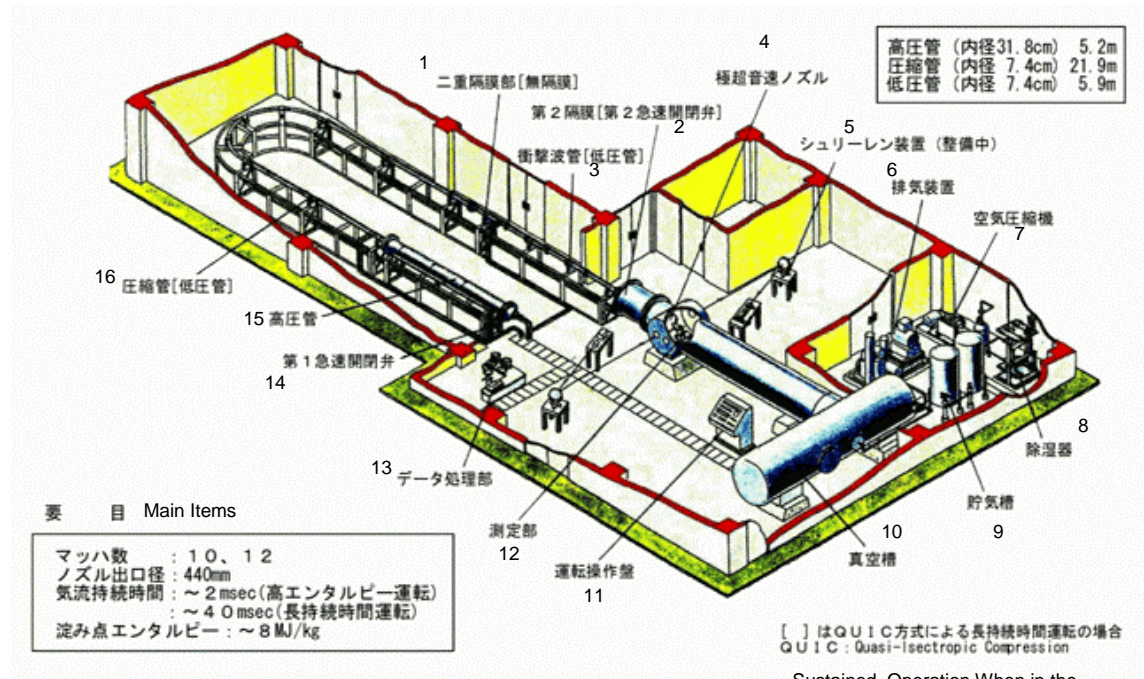
1. Double Diaphragm Section (Diaphragmless)
2. 2nd Diaphragm (2nd Rapid Open-Shut Valve)
3. Shock Tube (Low Pressure Tube)
4. Hypersonic Nozzle
5. Schlieren Device (Built-in)
6. Air Exhaust
7. Air Compressor
8. Dehumidifier
9. Air Storage Tanks
10. Vacuum Tank
11. Operating Panel
12. Test Section
13. Data Processing Section
14. 1st Rapid Open-Shut Valve
15. High Pressure Tube
16. Compression Tube (Low Pressure Tube)

### Upper Right Box

High Pressure Tube (Interior Diameter 31.8 cm)  
Compressor Tube (Interior Diameter 7.4 cm)  
Low Pressure Tube (Interior Diameter 7.4 cm)

### Main Items

Mach Number: 10, 12  
Nozzle Exit Diameter: 440 mm  
Air Flow Duration:  
~ 2 milliseconds (High Enthalpy Operation)  
~ 40 milliseconds (Sustained Operation)  
Stagnation Point Enthalpy: ~ 8 MJ/kg



## 0.44m 極超音速衝撃風洞全体図

**0.44m Hypersonic Shock Wind Tunnel, Japan Aerospace Exploration Agency (JAXA), Institute of Aerospace Technology (IAT), Aerospace Research Center (ARC), Wind Tunnel Technology Center (WINTeC), Tokyo, Japan.**



# European and Asian Wind Tunnels

Hypersonic

Japan

Installation Name	Test Section Size	Speed Range
Japan Aerospace Exploration Agency (JAXA), Institute of Aerospace Technology (IAT), Aerospace Research Center (ARC), Wind Tunnel Technology Center (WINTec), Tokyo, Japan	1.27 m (nozzle exit diameter)	10 Mach
		Temperature Range
	Date Built/Upgrade	
Facility Name	1994	Reynolds Number (million)
1.27 m Hypersonic Wind Tunnel	Cost	
		Dynamic Pressure
	Operational Status	
	Presumed active as of December 2005	Stagnation Pressure
		1 to 8.5 Mpa

## Supplementary Technical Parameters

Built by Mitsubishi Heavy Industries. Intermittent blowdown, vacuum suction type wind tunnel. Free jet type test section.

## Data Acquisition

## Testing Capabilities/Current Programs

Research on aerodynamics in a supersonic low-turbulence environment.

## Planned Improvements

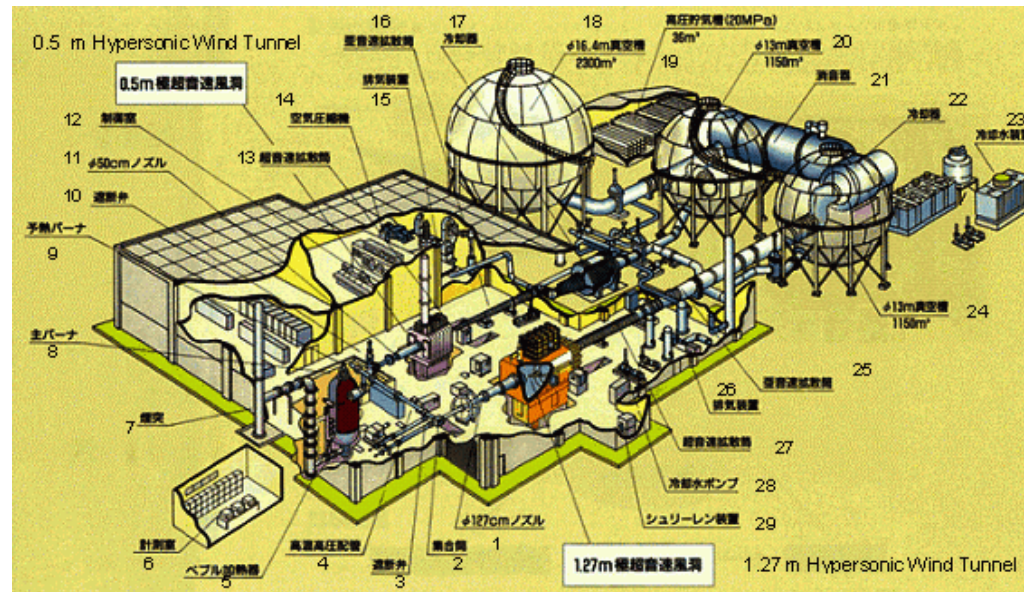
## User Fees

## Contact Information

Dr. Masashi Shigemi (WINTec Director), Japan Aerospace Exploration Agency (JAXA), Institute of Aerospace Technology (IAT), Aerospace Research Center (ARC), Wind Tunnel Technology Center (WINTec), 7-44-1 Jindaiji Higashi-machi, Chofu-shi, Tokyo 182-8522, Japan.

Tel: (81) 3 422 40 3000, Fax: (81) 3 422 40 3281, Email (Director): shigemi.masashi@jaxa.jp, Email (WINTec): wintec@chofu.jaxa.jp, Web site: <http://www.iat.jaxa.jp/res/wttc/b04.html>.

# European and Asian Wind Tunnels



**1.27m極超音速風洞 および 0.5m極超音速風洞全体図**

(Schematic of the 1.27 m Hypersonic Wind Tunnel and the 0.5 m Hypersonic Wind Tunnel)

Exploration Agency (JAXA), Institute of Aerospace Technology (IAT), Aerospace Research Center (ARC), Wind Tunnel Technology Center (WINTeC), Tokyo, Japan.

- |  |  |
|--|--|
| 1. $\phi$ 127 cm Nozzle                | 16. Subsonic Diffuser                            |
| 2. Settling Chamber                    | 17. Cooler                                       |
| 3. Shut-Off Valve                      | 18. $\phi$ 16.4 m Vacuum Tank 2300 m             |
| 4. High Temperature High Pressure Pipe | 19. High Pressure Air Storage Tank (20 MPa) 36 m |
| 5. Vapor Heater                        | 20. $\phi$ 13 m Vacuum Tank 1150 m               |
| 6. Measurement Room                    | 21. Muffler                                      |
| 7. Smokestack                          | 22. Cooler                                       |
| 8. Main Burner                         | 23. Cooling Water System                         |
| 9. Preheating Burner                   | 24. $\phi$ 13 m Vacuum Tank 1150 m               |
| 10. Shut-Off Valve                     | 25. Subsonic Diffuser                            |
| 11. $\phi$ 50 cm Nozzle                | 26. Air Exhaust                                  |
| 12. Control Room                       | 27. Supersonic Diffuser                          |
| 13. Supersonic Diffuser                | 28. Cooling Water Pump                           |
| 14. Air Compressor                     | 29. Schlieren Device                             |
| 15. Air Exhaust                        |  |



# European and Asian Wind Tunnels

Hypersonic

Japan

Installation Name	Test Section Size	Speed Range
Japan Aerospace Exploration Agency (JAXA), Institute of Aerospace Technology (IAT), Kakuda Space Center, Miyagi, Japan.	Nozzle size: 0.51 x 0.51 m free jet.	4, 6, 8 Mach
		Temperature Range
	Date Built/Upgrade	
Facility Name	1993	Reynolds Number (million)
Ramjet Engine Test Facility	Cost	5
		Dynamic Pressure
		10.3 Mpa (Mach 8); 5 Mpa (Mach 6); 0.87 Mpa (Mach 4)
	Operational Status	Stagnation Pressure
	Presumed active as of December 2005	575 kPa (Mach 8); 2.6 kPa (Mach 6); 5.5 kPa (Mach 4)

## Supplementary Technical Parameters

Maximum test duration: 30 seconds (Mach 8), 60 seconds (Mach 6), 60 seconds (Mach 4). Air flow rate: 7.92 kg/sec (Mach 8), 29 kg/sec (Mach 6), 42 kg/sec (Mach 4).

## Data Acquisition

## Testing Capabilities/Current Programs

Simulation of flight conditions for ramjet and scramjet engines at Mach 4, 6, and 8, at altitudes of 20, 25, and 35 km, respectively.

## Planned Improvements

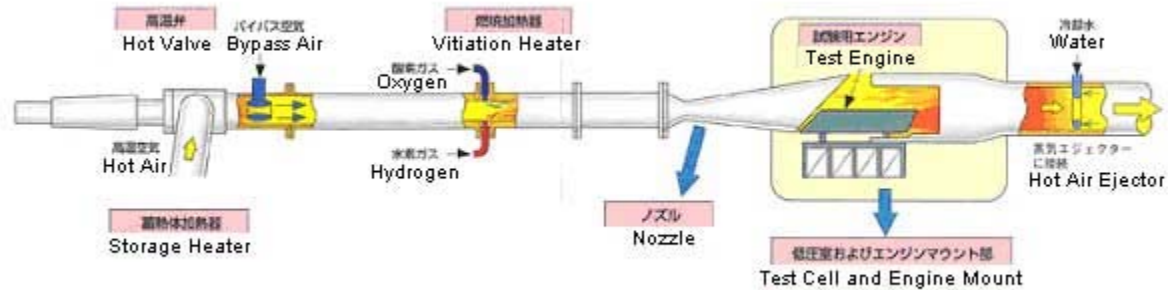
## User Fees

## Contact Information

Japan Aerospace Exploration Agency (JAXA), Institute of Aerospace Technology (IAT), Kakuda Space Center, 1 Koganezawa, Kimigaya, Kakuda-shi, Miyagi 981-1525, Japan.

Tel: (81) 224 68 3111, Fax: (81) 224 68 2860, Email: koho@chofu.jaxa.jp, Web site: <http://www.iat.jaxa.jp/kspc/eng/tf/rjtf.htm>.

## European and Asian Wind Tunnels



**Ramjet Engine Test Facility, Japan Aerospace Exploration Agency (JAXA), Institute of Aerospace Technology (IAT), Kakuda Space Center, Japan.**

# European and Asian Wind Tunnels

Hypersonic

Netherlands

Installation Name	Test Section Size	Speed Range
Delft University of Technology (TUDELFT), High-Speed Laboratory, Delft, The Netherlands	350 mm (diameter)	6 to 11 Mach
		Temperature Range
	Date Built/Upgrade	
Facility Name	1995	Reynolds Number (million)
Hypersonic Wind Tunnel (HTFD)	Cost	
		Dynamic Pressure
	Operational Status	
	Presumed active as of October 2005	Stagnation Pressure

## Supplementary Technical Parameters

Run time 0.07-0.13 seconds.

## Data Acquisition

## Testing Capabilities/Current Programs

Problems in hypersonic flight: the investigation of the external flow field around an ESA test model of a hyperboloid-flare, using Digital Electro-Optical Interferometry (currently under development as STW project) and flow research on the influence of the entropy-layer on boundary layer transition.

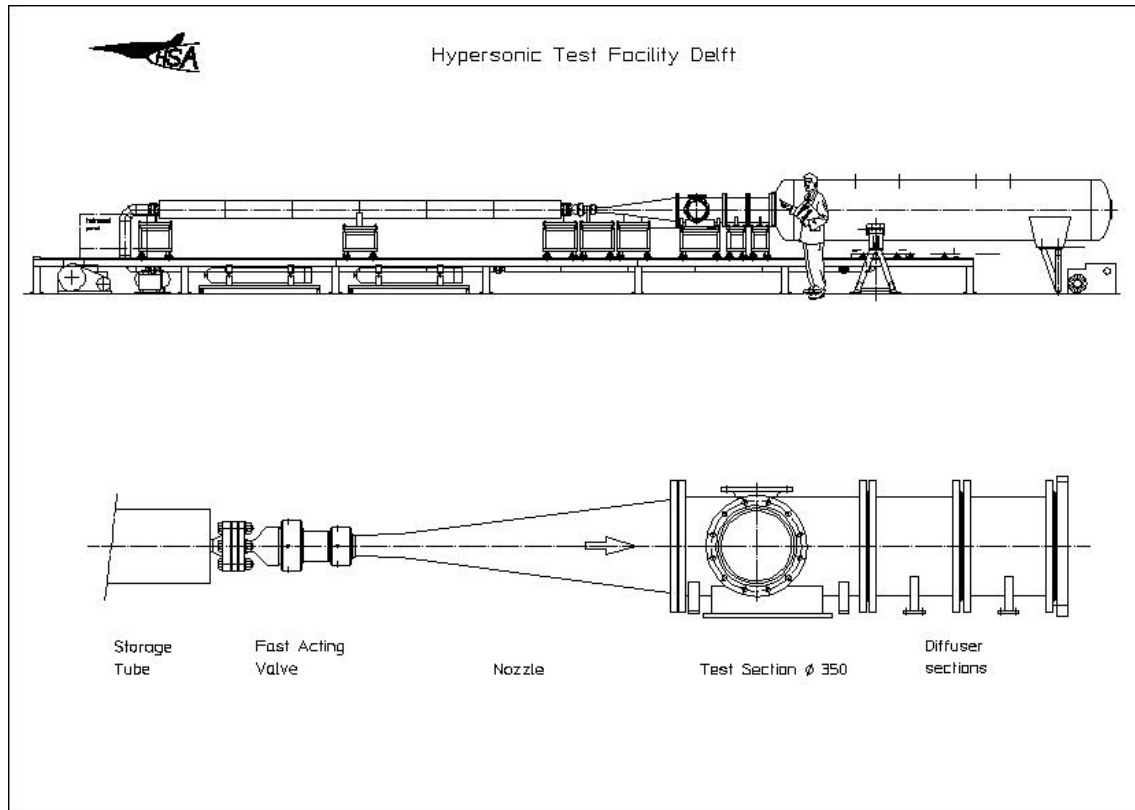
## Planned Improvements

## User Fees

## Contact Information

Delft University of Technology (TUDELFT), High-Speed Laboratory, Kluyverweg 1, 2629 HS Delft, The Netherlands.  
Tel: (31) 15 2784501, Fax: (31) 15 2787077, Web site: [http://www.aero.lr.tudelft.nl/ae\\_facilities\\_fr.html](http://www.aero.lr.tudelft.nl/ae_facilities_fr.html).

# European and Asian Wind Tunnels



**Hypersonic Wind Tunnel (HTFD), Delft University of Technology (TUDELFT),  
High-Speed Laboratory, Delft, The Netherlands.**

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**Unknown Speed**

<b>Country</b>	<b>Installation Name</b>	<b>Facility Name</b>	<b>Page</b>
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China	Northwestern Polytechnical University (NWPU, NPU), Xi'an, Shaanxi Province, China	NF-6 High Speed Continuous Pressurized Wind Tunnel	<a href="#">301</a>
China	Northwestern Polytechnical University (NWPU, NPU), Xi'an, Shaanxi Province, China	Small-Scale Adaptive-Wall Research Wind Tunnel	<a href="#">303</a>
China	Northwestern Polytechnical University (NWPU, NPU), Xi'an, Shaanxi Province, China	Small-Scale Low-Vortex Research Wind Tunnel	<a href="#">305</a>
Japan	Japan Defense Agency (JDA), Technical Research and Development Institute (TRDI), Tachikawa, Japan	Combustion Wind Tunnel	<a href="#">307</a>

# European and Asian Wind Tunnels

Unknown

China

Installation Name	Test Section Size	Speed Range
Beijing (Beihang) University of Aeronautics and Astronautics (BUAA), Fluid Mechanics Laboratory, Beijing, China		
		Temperature Range
	Date Built/Upgrade	
Facility Name	2000	Reynolds Number (million)
	Cost	
		Dynamic Pressure
	Operational Status	Stagnation Pressure
	Presumed active as of November 2005	

## Supplementary Technical Parameters

The Fluid Mechanics Laboratory has a total area of 2300 square meters. It consists of four low-speed wind tunnels, two high-speed wind tunnels, three 1.5-m low-turbulence wind tunnels, and Asia's largest demonstration circulating multi-purpose water tunnel.

## Data Acquisition

## Testing Capabilities/Current Programs

Nonsteady flow and vortex motion, turbulence and transition, hypersonic flow and advanced aerodynamic configuration, computational fluid dynamics (CFD).

## Planned Improvements

## User Fees

## Contact Information

Professor Sun Mao (Director), Key Laboratory of Fluid Mechanics of the the Ministry of Education, Beijing University of Aeronautics and Astronautics, 37 Xueyuan Road, Haidian District, Beijing 100083, China.

Tel: (86) 10 82317685/82317114, Web site: <http://www.buaa.edu.cn>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Unknown

China

Installation Name	Test Section Size	Speed Range
Northwestern Polytechnical University (NWPU, NPU), Xi'an, Shaanxi Province, China		
		Temperature Range
	Date Built/Upgrade	
	2002 or 2005	Reynolds Number (million)
Facility Name		15
NF-6 High Speed Continuous Pressurized Wind Tunnel	Cost	Dynamic Pressure
	Operational Status	Stagnation Pressure
	Presumed active as of November 2005	

## Supplementary Technical Parameters

China's first high-speed continuous pressurized wind tunnel.

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

Construction is underway of a lower temperature facility with Reynolds numbers that will reach 23, fully covering the range of the Reynolds numbers for rotary wings in actual flight.

## User Fees

## Contact Information

Northwestern Polytechnical University, School of Aeronautics, State Key Laboratory for Airfoil and Cascade Aerodynamics, No.127 West Youyi Road, Xi'an City 710072, Shaanxi Province, China.

Tel: 011-86-29-8492222, Fax: 011-29-8491000, Web site: <http://www.nwpu.edu.cn>.



## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Unknown

China

Installation Name	Test Section Size	Speed Range
Northwestern Polytechnical University (NWPU, NPU), Xi'an, Shaanxi Province, China		
		Temperature Range
	Date Built/Upgrade	
Facility Name	2002 or 2005	Reynolds Number (million)
Small-Scale Adaptive-Wall Research Wind Tunnel	Cost	
		Dynamic Pressure
	Operational Status	
	Presumed active as of November 2005	Stagnation Pressure

## Supplementary Technical Parameters

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Northwestern Polytechnical University, School of Aeronautics, State Key Laboratory for Airfoil and Cascade Aerodynamics, No.127 West Youyi Road, Xi'an City, Shaanxi Province, 710072, China.  
Tel: (86) 29 8492222, Fax: (86) 29 8491000, Web site: <http://www.nwpu.edu.cn>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Unknown

China

Installation Name	Test Section Size	Speed Range
Northwestern Polytechnical University (NWPU, NPU), Xi'an, Shaanxi Province, China		
		Temperature Range
	Date Built/Upgrade	
Facility Name	2002 or 2005	Reynolds Number (million)
Small-Scale Low-Vortex Research Wind Tunnel	Cost	
		Dynamic Pressure
	Operational Status	
	Presumed active as of November 2005	Stagnation Pressure

## Supplementary Technical Parameters

## Data Acquisition

## Testing Capabilities/Current Programs

## Planned Improvements

## User Fees

## Contact Information

Northwestern Polytechnical University, School of Aeronautics, State Key Laboratory for Airfoil and Cascade Aerodynamics, No.127 West Youyi Road, Xi'an City, Shaanxi Province, 710072, China.  
Tel: (86) 29 8492222, Fax: (86) 29 8491000, Web site: <http://www.nwpu.edu.cn>.

## European and Asian Wind Tunnels

**NO SCHEMATIC AVAILABLE**

# European and Asian Wind Tunnels

Unknown

Japan

<b>Installation Name</b>	<b>Test Section Size</b>	<b>Speed Range</b>
Japan Defense Agency (JDA), Technical Research and Development Institute (TRDI), Tachikawa, Japan	3.5 m (diameter), 12 m (long)	
		<b>Temperature Range</b>
	<b>Date Built/Upgrade</b>	248 to 928°K
<b>Facility Name</b>	1997	<b>Reynolds Number (million)</b>
Combustion Wind Tunnel	<b>Cost</b>	
		<b>Dynamic Pressure</b>
		0.01 to 3.8 kPa
	<b>Operational Status</b>	<b>Stagnation Pressure</b>
	Presumed active as of December 2005	

## Supplementary Technical Parameters

Air flow rate: 150 kg/sec. Pitch angle and yaw angle in the semi-free jet configuration: 0° ~ +15°, -5° ~ +5°, respectively. Simulation of flight conditions at 0 – 80,000 ft.; testing of ramjet engines in direct-connect (DC) or semi-free jet (SFJ) configurations; testing of solid fuel propellants consecutively in the booster phase, the transient separation phase, and the subsequent ramjet phase.

## Data Acquisition

## Testing Capabilities/Current Programs

Ramjet engine flight conditions and engine performance.

## Planned Improvements

## User Fees

## Contact Information

Japan Defense Agency (JDA), Technical Research and Development Institute (TRDI), 3rd Research Center, 1st Division, 1-2-10, Sakae-cho, Tachikawa-shi, Tokyo, 190-8533, Japan. Wind tunnel located at: Aerodynamic and Propulsion Test Facility of the Sapporo Test Center, 1032, Komasato, Chitose-shi, Hokkaido, 066-0011, Japan. Tel: (81) 123 42 3501.

Tel.: (81) 425 24 2411, Email: [info@jda-trdi.go.jp](mailto:info@jda-trdi.go.jp), Web site: <http://www.jda-trdi.go.jp/happyou.htm>.

## European and Asian Wind Tunnels

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